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PARASITISM ORGANIC AND SOCIAL

JEAN MASSART AND ÉMILE VANDERVELDE.

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PARASITISM
ORGANIC AND SOCIAL

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PREFACE.

EVERYONE remembers that the word Parasitism arose in the social world before it came into the organic,—here, indeed, agreeing with more biological ideas than naturalists always recognise.

Yet this book is of a new type. It results from the collaboration of a specialist in Natural Science with one in Economics. Hence it works out the old idea not only with modern detail and precision, but upon a higher spiral, comparing the wealth of Natural History facts with the wealth of Social ones, and thus giving a concrete instance of that practical union and unison of Biology and Sociology, which has been so long proclaimed by the philosophers but so little carried into practice. Perhaps it is in consequence of this lack of practical detail that an eminent American economist has lately committed himself to a proclamation of the "Failure of Biologic Sociology." We might almost agree with him if he had added "to begin operations."

Everyone is tired of misty phrases about "the social organism." Here, however, are the facts of life of particular lower organisms, compared with those of particular social ones. Some of them, no doubt, are ugly facts. That, however, is the fault of Nature and of Society, not of the writers; and in natural as in social things, it is often the ugly and the diseased which force themselves upon us, and which yet may yield us clues to higher truths and wider issues.

Of the details of treatment, of course, every naturalist and every economist will have his own opinion, and in so complex and concrete a subject no two workers would treat the subject in quite the same way. Our authors, as they themselves doubtless best know, have only opened the subject, not closed it. Their treatment is not exhaustive but suggestive.

A book of this kind gives a far better introduction to Elementary Biology than the primarily anatomical manuals current under that name. The science of life lies surely in the observation of life, not in the analysis of dead structure. In a word, our Science must start, not as too commonly with dissection, with Necrology, but with Life-lore, with Bionomics, and must return thither. Anatomical analysis is but a useful incident in its progress—a long and fascinating

parenthesis, which the naturalist has too often mistaken for the text. The true measure of our Biology lies not in following Cuvier, as the schools, through Huxley, still mainly do, but in reading the wealth and variety of living relations with Darwin. Hence the general reader may often become a more true biologist than the specialist, and the child who has mastered the inimitable (let us say rather the initiative) "Jungle Book" may have more of the spirit of the science than the graduate in Morphology.

Whether the reader does or does not approve of all the social comparisons, is again a matter of detail, and will not affect the essential character of the book, which I take to be meant rather to arouse discussions than to settle them; and to the student of social affairs, whether of conservative or advanced proclivities, the book may thus be commended. To the numerous worshippers of Comfort, and to the ingenious young person desirous of Getting On, it may also be warmly recommended as a suggestive manual. For others again it may add strength to the new commandment—"Thou shalt not exploit thy neighbour," though doubtless some may add—"Nor thyself for him." Thus it is that with each new step in Science the old problems are not wholly solved, yet are carried on to a new and higher level.

We may hope, finally, that not only our authors,

but other naturalists, other economists, may combine to carry out such parallel studies. There is surely ample room for like co-operation in other fields. There are many roads towards Utopia, but that of antithesis is often the shortest. So even here, from those ugly shapes of Parasitism, Organic and Social, we may descry the possibilities already nascent around us in man and in nature, of the highest as well as of the lowest ideals of Evolution. May we not, therefore, hope some day to see the antithetical title to the present one — Symbiosis, Social and Organic? Neither economist nor naturalist is ready to write such a book, yet no worker nor student but may bring his part towards this—the collaboration of collaborations.

PATRICK GEDDES.

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PARASITISM, ORGANIC AND SOCIAL

CHAPTER I.

Various Forms of Parasitism.

INTRODUCTORY.

This essay is not intended as an exposition of new facts in regard to parasitism. Indeed, we have deliberately restricted our illustrations to the familiar cases cited in most treatises on Botany, Zoology, and Social Science.[1] Our aim has been to correlate these facts, to show the relations between parasitism among plants and animals, and parasitism in human society.

Both from the biological, and from the sociological point of view, one may say that *the parasite is a being which lives at the expense of another without destroying it and without doing it service.*

[1] See the list of works cited. It seemed to us preferable not to burden the text with quotations or references.

In this definition there are two essential points:

(1) The parasite is useless or hurtful to its host; there is *no exchange of services* between them.

(2) On the other hand, the parasite does not destroy its host, *or, at least, it has no advantage in so doing.*

If one or other of these conditions be not fulfilled, there is no *parasitism;* but there may be *mutualism*, or *predatory exploitation.*

Predatory organisms do indeed live at the expense of others, but they destroy their prey; it is the death of the latter which enables them to live. But it is the continued life of its victim which keeps the parasite from dying. The tape-worm of the cat, for instance, is not likely to survive the animal which it infests; it is for its own interest not to kill its host.

On the other hand, when there is mutual advantage in the relations of two creatures, we cannot regard the one as a parasite on the other. Thus relations of mutualism, not of parasitism, exist between man and his domesticated animals, between some ants and the aphides, which are their "cattle," between the insects which fertilise the flowers and the flowers which supply nectar to the insects. It is true, indeed, that the inequality of the mutual service is often very

marked; domestication borders closely on slavery, and the master tends to become the parasite of the slave, or of the animal which he has appropriated to his service. Nevertheless, wherever there is, even in a faint degree, reciprocity in the services, we cannot strictly say that there is parasitism. Thus, for instance, in *Bonellia viridis*, a large marine worm, sack-like in form, and of a beautiful green colour, several microscopic males live in the reproductive organs of the large female; but we do not call them parasites, since they are indispensable to fertilisation, and thus to the continuance of the species. Sexual parasitism is only possible in society, where relations of this kind cannot be justified as necessary for the propagation of the race.

It is necessary to add, however, that we find every conceivable gradation between a predatory habit, mutualism, and parasitism. Classifications of this sort are simply for our convenience, and do not correspond to any actual limitations between the various groups of phenomena.

The same remark applies to the question which is discussed in our first chapter, whether we should include among parasites only those which live on the substance of others (nutritive parasitism), or also those which utilise only the energy and the products of others.

We shall afterwards treat of the evolution of parasitism and of the influence which the habit has on the parasite and on its host, endeavouring throughout to exhibit the relations between organic and social parasitism.

(*a*) ORGANIC PARASITISM.

§ 1. *Nutritive Parasitism.*

Organisms obtain the necessary food-supplies in very diverse ways, which are not readily separable from one another nor mutually exclusive.

I. The organism may obtain its food directly from inorganic material, as most green plants do. This mode of nutrition is termed *holophytic* (*a*).

II. Or the organism may be unable to utilise as food other than complex substances, which have formed part of, or have been formed by other organisms.

(1) Thus it may utilise the débris, the excreta, the dead bodies of other organisms. It is then said to be *saprophytic*, *coprophagous*, or *necrophagous* (*b*).

(2) Or it may live on the very substance of another organism, either destroying its

victim, as *predatory* organisms do (*c*); or exploiting it, after the manner of *parasites* (*d*); or getting nourishment from it in return for services rendered, as in *mutualism* (*e*).

These diverse modes of nutrition are all illustrated within one group, that of the Infusorians. Thus, there is a species of bell-animalcule or *Vorticella*, investigated by Engelmann, which possesses the green pigment, chlorophyll, characteristic of plants, and is therefore able to feed holophytically. Another Infusorian, *Opalina*, which lives in the hindmost part of the frog's food-canal, is coprophagous, feeding on the undigested remains of the frog's food. A predatory life is illustrated by the majority of the Infusorians which devour animalcules or very simple plants. Finally, some of the Acinetæ become parasites of these predatory forms, and mutualism is illustrated by a few Infusorians (such as one of the slipper-animalcules, *Paramæcium bursaria*), which contain minute green Algæ, and utilise the nutritive carbon compounds built up by their partners from carbonic dioxide and other simple substances. In this association of microscopic organisms we see a miniature of the reciprocal relations between the animal and plant life of the globe. For, although in the world at large the animals eat the plants, they restore to the atmo-

sphere the carbon which they have derived from the plants, and give back to the soil the mineral elements which the plants had, for the time, brought within the circle of life.

Among the more characteristic forms of animal and plant life, the modes of nutrition are specialised, and do not show that astonishing diversity which we find among Infusorians. Thus the seed-bearing plants or Phanerogams are almost exclusively holophytic, and the backboned animals or Vertebrates are, with few exceptions, predatory. Similarly, most of the mushroom-like Fungi (Basidiomycetes) are saprophytes, and the tape-worms or Cestodes are wholly parasitic.

Among these different modes of nutrition, the holophytic method is evidently the most primitive. For one cannot conceive that the first living creatures which appeared on the earth can have fed on anything but inorganic matter.[1]

The primitive holophytic organisms must have been followed by those which were able to feed upon organic débris, and to reduce that once more to inorganic material. The occurrence of saprophytes is essential to the conservation of life. If the saprophytic, coprophagous, and necrophagous organisms

[1] [It is at least *conceivable* that they fed on organic compounds which did not achieve vitality. See Ray Lankester's article, *Protozoa*, "Encyclop. Britannica."—*Tr.*]

disappeared, dead bodies and excreta would accumulate on the earth's surface, all the material utilisable by animals or by plants would be locked up in the remains, and if there were no power to restore the dead material to an inorganic state, the earth would soon become nothing but a gigantic charnel-house.

Thus it was only after the establishment of holophytic and saprophytic organisms that it was possible for predatory, mutualist, or parasitic forms of life to appear.

The parasites may have been derived from forms which found their sustenance in any of the four ways already mentioned. The Rhinanthaceæ, such as the yellow-rattle, are derived from holophytic Scrophulariaceæ; the Fungi which live at the expense of other plants are often traceable to saprophytic ancestors; the barnacle-like Cirripedia which exploit crabs are descended from carnivorous crustaceans; and the humble-bees which steal the nectar of the toad-flax (*Linaria*) began with taking the honey as a reward for carrying the pollen from flower to flower.

The gradual origin of a parasitic habit, a matter which we shall afterwards discuss in detail, is enough to explain why there is no rigid line of demarcation between parasitism and the various modes of nutrition from which it may arise. In a large number of cases the parasite is only partially dependent on its host,

and partially self-supporting; but it hardly needs to be pointed out, that the parasitism is the more marked, and its consequences are the more obvious, the less effort the parasite requires to make in securing its subsistence, and in assimilating the food which it has utilised. We shall show how this is illustrated by the various modes of nutrition already indicated.

I. Holophytic plants obtain their food from two main sources:—the soil, from which they absorb water and soluble mineral matter; the atmosphere, from which they derive their supplies of carbon.

Certain parasitic plants, such as the mistletoe, take from their host only the water and inorganic substances derived from the soil, for they have green leaves and are only destitute of roots.

Others, such as the Orobanche and the dodder, utilise the elaborated organic substances of their victims; they can dispense not only with roots but with leaves. For it is in the leaves that a plant manufactures, out of the raw materials of earth and air, the complex molecules which form its substance.

II. Among organisms whose mode of nutrition is other than holophytic, among animals, for instance, or mushrooms and other saprophytic plants, the degree of parasitism is in proportion to the number of activities the parasite is able to dispense with.

(*a*) Those parasites which live at the expense of

animals show more or less degeneration according to the period at which they avail themselves of the nourishment afforded by their host.

Thus the Isopod crustaceans, which live in the mouths of fishes and take their food just as it has been seized, before it has been subjected to any process of digestion, have retained all their digestive organs. To this type of parasite Van Beneden has applied the term *commensal.*

Worms and other animals which infest the alimentary canal illustrate a more advanced stage of parasitism; they take food which has been more or less digested, and therefore they are able to dispense with, and are generally without, those organs whose function it is to render the food diffusible.

Finally, those parasites which live in the blood and the tissues, and thus obtain completely assimilated material, are in most cases without any digestive system. They are fed by diffusion from the nutritive medium in which they are bathed.

(*b*) Certain saprophytic, coprophagous, or necrophagous species may become completely transformed into parasites; others, while preserving their original mode of nutrition, may exhibit characters which link them more or less closely to parasites.

Thus the spores of certain Ascomycetous Fungi which live on dung can only germinate if they have

first passed through the food-canal of some animal such as the rabbit. Thanks to their mode of nutrition, these Fungi, like all the others, are able to dispense with chlorophyll.

We find a similar illustration in the common thread-worm *(Oxyuris vermicularis)* which lives in the rectum of man, and though feeding merely on the fæces, is dependent on its host for lodgment.

In neither of these cases is there in the strict sense any nutritive parasitism, but we are naturally inclined to include them within our conception of parasitism, and they suggest what we shall now consider as a second mode of parasitic exploitation—the utilising of another's energy.

§ 2. *Parasitism involving the Exploitation of Energy.*

Belonging to this category are those organisms which rob another creature of part of its physical energy.

These are not usually regarded as parasites, although it is plain enough that one may live at another's expense by utilising his energy as well as by robbing him of his substance. Of course it is a question of definition, but it seems to us useful to bring those forms which take advantage of the energy of their neighbours, or of external resem-

blance to them, under the same category as those which borrow nutriment. For there are very close affinities between these phenomena,—affinities often unrecognised, since the facts are studied separately.

Among plants, then, we have, besides nutritive parasitism, parasitism of support, illustrated by those plants which live directly perched upon their bearers (epiphytes), and those which rise on their neighbour's shoulders, and are thus the better able to expose their leaves to the light (twining and climbing plants).

The animals which illustrate analogous relations generally utilise their host not merely for support but as a bearer.

Such, for example, are the Remoras, little fishes which anchor themselves to sharks by means of a peculiar suctorial apparatus, or the minute mites which attach themselves to the large violet beetles one sees on the highways, and are carried by them from one heap of dung to another.

We may also reckon as parasites those animals which seek only lodgment and shelter from their hosts. Such is notably the case with the pea-crabs (*Pinnotheres*), little creatures about the size of hazel-nuts, which are found within the shell of the horse-mussel (*Modiola*) and other bivalves, taking refuge there whenever any danger forces them to interrupt their hunting.

For the same end—protection—the hermit-crab

shelters his soft unarmoured abdomen within the empty shell of some mollusc. Seeing that the rightful tenant is dead,[1] we can hardly, in this case, speak of parasitism for support, any more than we can attribute nutritive parasitism to those organisms which live on corpses. In neither case does the animal live at the expense of another; it merely takes advantage of its neighbour's remains.

§ 3. *Mimetic Parasitism.*

We may speak of a "parasitism of livery," or mimetic parasitism, when one organism mimics another in form and colour, in such a way that it derives some advantage from the resemblance. What links mimicry to parasitism is the fact that it is necessarily prejudicial to the mimicked.

Let us illustrate this by several examples of different kinds of mimicry.

1. A carnivorous species mimics an inoffensive species in such a way that it is able to approach its victims without frightening them.

2. One species mimics another in such a way that it is readily able to approach the latter to do it some harm.

3. A weak and palatable species mimics one which is well-defended and unpalatable, in such a way that,

[1] [The hermit crab does not always wait until the mollusc is dead.—*Tr.*]

on the strength of the resemblance, it is able to escape from its enemies.

Among the mimetic parasites of the first group, we may cite those spiders which mimic ants. There is no doubt that this mimicry is, to a certain extent, disadvantageous to the animals mimicked, for it exposes them, in spite of their peaceful ways, to the risk of being taken for evil-doers, and treated as such. The disadvantage is much more obvious when one species mimics another for the purpose of attacking it more readily.

Bates found on the banks of the Amazon a species of Mantis which exactly resembles the termites on which it feeds. It is indeed a wolf in sheep's clothing.[1]

In cases where the mimicry is purely defensive, one does not see clearly at first glance how the mimicking species does any harm to the species mimicked. It does, nevertheless, as an illustration will clearly show.

In the tropical forests there are butterflies which are protected from the attacks of birds by their nauseous taste, of which their brilliant colouring is believed to convey a warning. These butterflies, belonging to the family Heliconidæ, are mimicked by

[1] Fredericq: "La Lutte pour l'existence chez les animaux marins," p. 119.

other palatable butterflies, belonging to the family Pieridæ, and that with such exactness of detail that their enemies are misled, that entomologists have been deceived, and that the males of the one kind are known to have made advances to the females of the other. Thanks to this resemblance, the Pieridæ are not troubled by birds who have experimented on the Heliconidæ; but, on the other hand, and here is the disadvantage to the mimicked, the latter are often attacked by young birds who have begun with the Pieridæ.

It is to be noted that in the forests frequented by these two groups of butterflies the Heliconidæ, which are really protected, are much more numerous than the Pieridæ, whose safety is solely due to the mimicry. Indeed, the resemblance is of no avail unless, as happens in most cases, the palatable form occurs along with its unpalatable double, which the insectivorous bird has learned to avoid. Were the proportions reversed, the birds accustomed to attack edible animals would soon have destroyed the nauseous minority along with the palatable majority.

The fact which we have just noted in regard to the numerical preponderance of the exploited Heliconidæ over the exploiting Pieridæ is but a particular instance of a general law concerning parasitism. In nutritive parasitism, the victim should be larger than

that which lives on it; in parasitism of support, the bearer should, of course, be the stronger; in mimetic parasitism, the species mimicked should enjoy numerical preponderance.

It is so, for instance, with the white dead-nettle (*Lamium album*), which exhibits the characteristic features of the quite unrelated stinging-nettle (*Urtica dioica*). The stinging-nettle is protected against herbivorous animals by means of its stinging hairs; and the white Labiate, which has no such weapons, profits by the fear which its counterpart inspires. On the other hand, it may happen that the stinging-nettle is attacked by animals which have previously had experience of the harmless Labiate.

Another note which applies to all cases of mimetic species is that the dead-nettle has the same geographical distribution and grows in the same places as the stinging-nettle. Thus mimetic parasitism, like all other forms of organic parasitism, demands the existence of certain direct relations between the exploiters and the exploited.

Furthermore, between the different kinds of parasitism, there are other affinities which it is of importance to notice. We have already seen that the less marked phases of nutritive parasitism merge with cases of saprophytism, and that parasitism of support in the Pinnotheridæ is related to the manner in which

the hermit-crab utilises the shell of a dead mollusc. So in regard to mimicry there are analogous phenomena; certain Lepidoptera, notably *Kallima paralecta*, resemble dead leaves; other insects resemble the excreta of caterpillars both in form and colour; there are other arthropods which look like fæces or dead remains, such as the spider *Ornithoscatoides decipiens*, which owes its name to its extraordinary resemblance to the droppings of a bird, and on the strength of this is able to seize the butterflies which are wont to settle on these evacuations.

The parallelism between the three modes of parasitic exploitation might be traced in greater detail. For instance, we have seen how plants proceed by gradual stages from the holophytic mode of life to that of out and out nutritive parasitism. Furthermore, many plants which ordinarily perch themselves on the trunks of trees are found from time to time growing on rocks, or sending roots into the ground, thus returning to an inorganic support, just as we arrived at holophytic nutrition when we traced backward the steps by which nutritive parasitism arose among plants. Lastly, the same holds good of mimetic parasitism: for at the climax of that process we have the elaborate imitation of the living organism, then of its cadaver or its excreta, till, finally, we arrive at homochromia, that is, the adoption

by certain animals of the prevailing colour of their environment. To this latter tendency we refer the whiteness of polar animals, the tawny colour of desert animals, and the almost perfect transparency of pelagic organisms.

The whole series of gradations from homochromia to parasitic mimicry may be verified within the limits of a single order, that of the insects. The weevil of the dunes has the light colour of the sand, and the grasshopper wears the green of the world it lives in. Many caterpillars, notably the Geometridæ, assume, on being disturbed, the appearance of dry twigs; while we have already seen that certain Lepidoptera are able to masquerade as dead leaves. Finally, there is a large drone-fly called *Volucella*, which is externally very like the humble-bee, though belonging to a different order of insects. Under cover of this resemblance it approaches the nests of the latter and deposits its eggs therein. The larvæ come forth in due course and feast on the honey and other provender which the bees had stored up for their own brood.

(*b*) SOCIAL PARASITISM.

§ 1. *The Differences between Organic Parasitism and Social Parasitism.*

The three kinds of exploitation just described—parasitism of nutrition, of energy, or of appearance—are found in the social world as well as in the sphere of animal and plant life; with characteristic differences, however, which have to be recognised and allowed for from the outset.

Most fundamental and far-reaching of these is this, that—waiving a few exceptional cases to be spoken of later—social parasitism is possible only between beings belonging to the same species, whereas organic parasitism can only exist where there is difference of species. For it is quite inconceivable that an animal or plant should draw its nutriment continuously from another of its own kind without destroying it: or even that it should exploit the energies of its fellow for any length of time without exhausting the latter's vitality. And mimetic parasitism within the same species is even more obviously out of the question, seeing that all the members of the same species do already, *ipso facto*, wear the same livery.

If organic parasitism is impossible between individuals of the same species, social parasitism can

only exist between beings living in social groups, as the term shows. But social groups (for instance bees, ants, beavers, men) consist nearly always of individuals of the same species.

Instances may indeed be cited of a social group of animals being exploited by an attendant parasitic species. Thus there are blind beetles found in ant-hills, living at the expense of the ant-community and rendering no service in return. Even more obviously of this ignoble sort are the plundering robber-gulls, which fly in the wake of the gregarious sea-mews, and steal from them their catch of fish. Here we are at the meeting-point of organic and social parasitism, and are reminded once more that Nature shows little in the way of fixed landmarks or dividing lines. There seems to be wonderfully little difference between the parasitism of these robber-gulls and that of the crustaceans already mentioned, which lodge in the mouths of fishes and help themselves to the minute organisms which their hosts have caught for their own consumption.

Discounting these transitional cases, however, it may be maintained that social parasitism is only possible between individuals belonging to the same species; and that from this fundamental distinction all the other characteristic differences between social and organic parasitism may be traced as corollaries.

Let us briefly note what these differences are.

1. The social parasite does not directly consume the substance of the organism exploited. It only robs the other, more or less completely, of its means of subsistence, and more especially (in cases which approach organic parasitism) of its food-supply.

2. In the social world parasitism is a characteristic of individuals, while in the organic it is a characteristic of species. The latter have travelled slowly towards that physiological character or habit. Natural selection has furthered the process and raised the parasitic habit to the dignity of a specific character, organically transmitted. In human society, on the other hand, the parasitic disposition or habit is formed by each individual in his own life-time, and remains an acquired and individual mark which is not organically transmissible. The progeny of a tape-worm can only be tape-worms, and must live in the intestines of another organism; but in the social world there is no class of beings similarly bound by organic fate to a parasitic mode of life. Degenerate parents do, it is true, rear degenerate offspring, just as it is true that those who have a good heritage transmit the benefits to their descendants. But nothing in the nature of things requires that the heirs of the degenerate shall be parasites, or, if they do, that they shall be of the same order of parasites as their parents

were. Imitation, in fact, is the starting-point of this habit in the social world, and plays therein, as M. Tarde has pointed out, a part not less important than that of heredity in the biological sphere.

3. In studying social parasitism it is necessary to consider it in relation to the whole community, not in relation to the person or persons who may be attacked. Usurers, swindlers, and other evil-doers, must be regarded as parasites of the social body, and not of this or that victim whom they may happen to have preyed upon; just as the naturalist looks on the *Trichina* as an enemy of the pig and not of the particular tissues or organs it infests. For, indeed, the individual exploited by the social parasite may find it very natural, or even—as in the case of prostitution—very pleasant to submit to such exploitation. But the social body is injured none the less in its substance, that is to say, its resources.

It may be said, generally speaking, that the features presented by social parasitism are less stable and less deeply marked than is the case in organic parasitism. Between the three forms—nutritive, exploitary, and mimetic—there are no fixed dividing lines, and all three may sometimes be found together in the same individual. Thus a sinecurist may be at one and the same time a parasite (*a*) upon those by whom his salary is paid, (*b*) upon those who defend him, and

from whom he borrows the social leverage by which he gains advancement, and finally (c) upon the working officials whose credit he shares, or who are discredited, it may be, on account of his uselessness and indolence. In the same way a sturdy beggar who feigns infirmity is a parasitic exploiter, not only of the community which keeps him, but also of the truly infirm, who are injuredby his counterfeiting.

§ 2. *Nutritive Parasitism.*

In speaking of the sources whence living things draw their food supply, we have seen that they draw it either from inorganic matter, from the detritus, excreta, or dead bodies of other organisms, or from the actual substance of other living organisms. Similarly in the economic life of society, the members of a given social group may be described as gaining their means of subsistence either

(1) Directly from the store of nature, or

(2) By utilising the waste products of production, or the residues of consumption, or

(3) By appropriating a share of the goods which others have taken from the ground.

The first of these modes of gaining a livelihood is the most frequent in animal communities and among uncivilised races. At a higher stage of social development it is still represented by the classes

engaged in hunting, fishing, agriculture, and the extractive industries. These were regarded by the physiocrats as the only productive classes, on the ground that they brought into the economic world the raw materials of all wealth, which others could only elaborate or apply.

The second group consists of what may be called the saprophytes of society. To it belong all those who manage to keep themselves alive by turning to use things which have been cast aside as waste by producers or consumers. Such, for example, are gleaners, old-clothes-men, rag-pickers, those mud-larks who scout along the shore for the upcastings of the sea, those who scrape up the droppings of horses and cattle to sell them as manure, or those whose day's work consists in searching the streets for cigar ends. Even more obviously saprophytic are the nameless creatures who swarm in the slums of Eastern cities, and whom Flaubert called *the eaters of dirt.*

Finally, the third group consists of those who draw nothing directly for themselves from the store of Nature, but who appropriate a share of the supplies which others have gathered. Individuals of this group may be either predatory exploiters, mutualists, or parasites.

There is predatory exploitation or rapine, when

the object attacked is destroyed outright to enrich the aggressor. We see this not only in the wars of extermination to which savage or barbarous communities commit themselves, but also in the furious battles that are sometimes fought between different societies of ants and termites.

Mutualists are those who render an equivalent in services to the workers who supply them with the raw material of goods. Such, for instance, are all those who are engaged in the manufacturing (elaborating) industries, in transport, in commerce, in personal service, and in all public offices and departments. A similar division of labour is found to exist in certain animal communities, notably among ants: for besides the great body engaged in amassing wealth from the surrounding world, there are squads of workers whose sole business is to build granaries, to house the harvest, or to defend the common treasury from attack. Nay, in a certain tropical species there is even a class of individuals who have been called reservoir ants. Their duty is, apparently, to serve as living warehouses, their abdomens being packed, till they distend like a leather bottle, with the honey which their tribesmen have gathered.

Lastly come the parasites, who may be derived from any of the preceding classes. Thus they may be farmers grown rich and indolent, public

functionaries whose office has lapsed to a sinecure, or soldiers degenerated into thieves and loafers. Speaking generally, we may say that to this category belong the individuals or the social classes who are either useless or mischievous to the community which harbours them.

The aim in life of these parasites being to consume without producing, the methods they employ may be classified thus:

1. Fraud or violence.

2. Exploitation of debauchery and the sexual passions.

3. Useless public offices.

4. Private appropriation of the means of production.

We shall therefore distinguish social parasitism under four headings—predatory, sexual, political, and proprietary. But be it at once understood that we by no means wish to level a charge of parasitism against all "persons of independent means," or all officials whose office may be a sinecure. There are, undoubtedly, many belonging to both these classes, who employ their leisure in the elaboration of works, for which there is little or no money reward, but which are of the utmost value, none the less, to the nation. Still, it will hardly be denied that wherever large classes of persons are in a position (whether by virtue of useless public functions or hereditary

privilege) to live, if they choose, an entirely idle life, there are always a great many willing to make the worst use of the leave given them.

Thus, in the social, as in the organic sphere, the smaller the amount of effort required in exploiting its victim, the more accentuated and typical becomes the parasitic character of the exploiting agent.

1. *Proprietary Parasites*, therefore, present the ideal form of such exploitation; they are the tape-worms of the social body. Their riches come to them as easily as its food-supply comes to the *Tænia solium*, the capitalistic levy being deducted from the produce, as a first claim, with automatic regularity. From the moment when you become a proprietor of the land, of houses, or of the machinery of production, you may, as Henry George says, sit down and smoke your pipe, you may lie about like the lazzaroni of Naples or the lepers of Mexico, you may go up in a balloon or dig a hole in the ground, and all the time, without any act of yours,[1] the rent of house and farm, and the interest on your other capital, will keep dropping steadily into your hands.

2. Under the designation of *political parasites* come all kinds of sinecurists, from courtiers of the most dazzling order to the obscurest supernumerary.

[1] [The act may have been, surely, in the past—the labour of acquiring the property.—*Tr.*]

These can hardly be considered workers any more than can the proprietary parasites; yet they all affect, more or less, the semblance of some useful function. Partly on this account, a respect for tradition keeps them alive, and even, as we sometimes find, succeeds in instituting new functions of the most obviously useless sort. In his work on the "Ancient Regime," M. Taine gives a complete list of what were called honorary or "gracious" offices at the court of Versailles; these were, in fact, supernumerary posts. The *Intendant des chasses* (Steward of the Royal Hunt) drew 18,000 livres for signing his name twice a year; the Guard of the Queen's Bed received 12,000 livres, although no one knew what were the duties of his office, which had been in abeyance since the days of Anne of Austria, and was only reinstituted in the eighteenth century. Let us also cite the two stool-bearers to His Majesty; these gentlemen came every morning, clad in velvet habits and with swords at their sides, to "verify" and, if forthcoming, to empty the objects of their office. The duty was worth to each of them 20,000 livres a year.

A number of analogous cases are to be found in England to-day, the classic home of mediæval survivals, where such offices are preserved in the midst of a modern environment like insects in amber. That miraculous official, the Opener of the Bottles of the

Ocean, may, indeed, have been an invention of Victor Hugo's, but assuredly the Lord Warden of the Cinque Ports,[1] who probably never set his feet within the docks, draws as handsome a salary for quite as needless an office.

3. Under the designation of *sexual parasites* come all those who find their livelihood in other's debauchery; either putting their own persons to traffic (prostitution), or exploiting the persons of others (proxenetism, bawdry). Of proxenetes there are many varieties. We need only refer to the parents who live by the prostitution of their children, the husbands who exploit their wives, the keepers of certificated houses (who form a link between the sexual and the proprietary modes of parasitism), the many different sorts of *souteneurs*, from the "bully" (*marlon*) of the Paris barriers to the "fancy-man" (*lanceur*) of the demi-monde, and other degraded forms of pandering and exploitation (*maquerellage*).

Sexual parasites cannot devote themselves to the sluggish, effortless type of life which is the privilege of the "independent" and the sinecurist classes. If they would ensure a livelihood they must act, they must bring into play certain faculties serviceable in their calling. The prostitute must make efforts to

[1] [It may be said, however, that the Lord Warden receives office in recognition of past services.—*Tr.*]

attract customers, the *souteneur* to keep hold of the woman who feeds him (his *marmite*), the brothel-keeper to direct his business profitably. While, therefore, their degradation is generally much greater, owing to their condition in life being wretched, it is nevertheless true that their parasitism is much less pronounced in kind than that of the idlers of our first and second category.

4. *Predatory Parasites* (called by Fourier scissionaries) are all those who rob society of part of its revenue, by fraud or force. Such are usurers, professional criminals, stock-jobbers, or more typically, those money-changers whose occupation consists entirely in trying to turn to account the difference between the standard and real weight of the currency, by withdrawing from circulation the heavier pieces and sending out the light ones. In all these parasites there is a noticeable development of certain ignoble faculties, certain special aptitudes; so that their intellectual activity is much greater than that of the "independent" person stowed away in the inner organs of the social body, living like a cheese-mite in the midst of his food.

This difference becomes more apparent when we turn our attention to those depredators who bear the same relation to other parasites as gnats and mosquitoes and, generally, all external pests do to the

tape-worms or to those parasitic organisms which make their home in the blood of their victim. Thus the wandering bands of Arabs who plunder the oasis, and the Cochin-China pirates who molest the French Settlements, display a degree of physical and intellectual vigour far exceeding that of the oasian populations or the agricultural folk of Tonquin. Mr. Benedict declared, at the last Congress of Criminal Anthropology, that the Hungarian brigands whom he had known were superior to the peasants of their district. They could hardly be regarded as typical parasites any longer, indeed, for, had their numbers been greater, they would have been able to overthrow the community which they attacked, and so would have taken rank as a predatory horde, pure and simple.

We have thus run through the whole series of transitions from proprietary parasitism to those forms which merge in predatory exploitation. In concluding this section it may be as well to say that though the parasitic character is more accentuated, more deeply marked in one class of cases than in another, this difference of degree does not in itself constitute either superiority or inferiority of one class to another. We only wish to set down the fact that the proprietary parasite may live, if he likes, an absolutely effortless life, whereas parasites of other kinds must, in order to gain their livelihood, bring into play a

greater or less amount of energy and effort. Also, there is but little doubt that, other factors (heredity, environment, etc.) being equal, the most inactive are also the most degenerate.

§ 3. *Parasitism involving the Exploitation of Social Energy.*

Here we consider those individuals or classes who live at the expense of others, not by appropriating a share of their food-supply or livelihood, but by draining-off a part of their working-power, or sapping their social energy.

1. *Working-Power.*—Here, be it understood, we have not to do with such relations as those existing between Remora and shark. With the best will in the world we cannot force a perfect analogy between these and the relation described by Sir Samuel Baker: "King Katchiba, being ill at walking, was wont to travel on the back of an able-bodied subject. He usually went about accompanied by two men, who relieved one another, each acting alternately as guide and as steed."

We have to consider under this heading relations much more widespread and more permanent in societies, and to distinguish the methods whereby certain individuals or social classes utilise for them-

selves the working-power, physical and mental, of other individuals or classes.

At the level of manual labour, this variety of parasitism is most typically exemplified in the feudal institution of the *Corvée*. It gave to landowners—mostly absentees—the right of exacting certain services from their "subjects," for which services they gave no return benefits whatever. Out of hundreds of examples we need cite only one, namely, the "Meadow Rights" (*droit de préage*), in virtue of which the seigneur could send his horses, cows and other cattle to graze "under strict custody" (*à garde faite*) in the fields of his subjects. This meant that the latter had actually to safeguard the droves that were devouring their substance.

As to the exploitation of mental working-power, we must regard as parasitic all those who infringe the intellectual copyright, so to speak, of another—from the common plagiarist who cuts himself out a reputation with a pair of scissors, to those "brain-suckers" who attribute to themselves the discoveries of assistants, or publish under their own name the literary labours of poor devils who are in their pay.

2. *Social Energy.*—Every public man carries in his train, while his career lasts, a certain number of individuals who gain favour or derive advantages more or less considerable, from the mere fact that

they are personal friends or kindred of his. Favouritism and nepotism do real harm not only to the community, but also to those who are constrained to grant those favours and connive at those advantages. How many statesmen have owed the ruin of their popularity not to the character of their public acts, but to the compromising results of their friendship! The organised clientage at Rome in the time of the Empire stands out as the most classic example of such exploitation of social power, and none shows in a clearer light the lamentable consequences of such a relation for both parasite and host. There, in addition to the immediate clients who were materially dependent on their patron, there was an outer circle of hangers-on, whose function in life was to turn to account the influence which these favourites could put at their disposal.

§ 4. *Mimetic Parasitism.*

Mimicry is extremely common in the social world. There we find individuals or groups apeing other individuals or groups, and for the same reason that plants and animals borrow the livery of other species.

Sometimes the object is purely defensive; as, for example, when a proscribed exile returns to his

native country, and disguises himself to elude the vigilance of his enemies. Sometimes, on the contrary, the mimicry has a directly offensive aim. Then we have to do with a case of veritable parasitism, and with acts which are harmful to the whole community, especially to the individuals who are mimicked.

The mimetic parasite may be considered under either of two aspects; either, that is, as seeking to exploit the persons mimicked, or as aiming his designs at other people altogether. But in both cases he injures the individuals or groups whose habit he affects. Take one or two examples:

1. Beggars who procure assistance by simulating accident or disease prey not only upon the charitable institutions and relief societies which they exploit, but in equal degree upon the truly indigent, or infirm, or sick, from whom they divert some part of the ready belief and sympathy of charitable people. The same effect is produced in trades-unions by idlers who pretend that they cannot get work, and who thus succeed in drawing part of the relief-fund which belongs to the honest unemployed.

2. Those who make a profession of going to public auctions and bidding up the price of articles which they have no intention of acquiring, are parasitic

pests to the *bonâ fide* purchaser, in whose character they masquerade for the moment.

If we pass now to those examples of mimicry that have for their object the spoliation of the public, we find that here also injury is done to the persons mimicked.

1. The charlatans who abuse the confidence of simple people by an affectation of religious sentiments which do not really belong to them are parasites upon the priests and monks who discharge their ministry in sincerity and good faith. Similarly with the swindlers, who arrogate to themselves the qualifications, titles, and distinctions of others, and lower the value of these qualifications by shaking the confidence which they would otherwise inspire.

2. Sometimes commercial or financial enterprises of an absolutely speculative character assume the co-operative form in order to elude the rigour of the patent laws, and to save themselves from the scrutiny of the assessor of taxes. The nature of their operations prejudices, to an appreciable extent, the success of the co-operative movement. There was founded at Brussels, not long ago, a "co-operative society" of sugar-manufacturers, with a minimum capital of 175,000 francs, in shares of 25,000 francs each. Here we are far enough away from those unambitious associations of workmen which the legislature had in

view at first; and it is partly to such cases as these that we must attribute the abolition of a number of the fiscal immunities formerly enjoyed by co-operative associations.

3. The learned professions, or those to which a diploma is attached, afford equally interesting examples of mimicry. It is a fairly uncommon thing to find that amount of capacity in the diplomate which the diploma seems to guarantee. What relation is there, for instance, between a purely theoretic examination, referring to matters which can be got up by sheer force of memory, and the real work of a profession such as that of lawyer or doctor, where so much depends upon the exercise of special aptitudes, of which an examiner can take no account since he cannot verify them?

It has therefore been said, truly enough, that "The members of the public who are least deceived as to the real worth of the various university degrees are those who possess one or other of them. The bulk of the community is daily imposed on by the prestige of a qualification which it does not share." This gullible attitude is turned to account by crowds of persons who were chronics and dunces while at college, but who have at last succeeded in gaining a diploma wherewith to cloak their incompetence. Their subsequent practice results in injury not only

to the public but to their professional brethren and colleagues, whose moral authority they enfeeble by constantly belying the presumption of capacity that goes with the possession of a technical qualification or diploma.

CHAPTER II.

The Evolution of Parasitism.

The parasitic mode of life is necessarily derived from one or other of those modes which we enumerated in an earlier part of this essay. It would be exceedingly interesting to know accurately what are its beginnings and predisposing causes. But the difficulties of investigation are so great—especially in the case of organic parasitism—that this branch of research has, as yet, hardly been touched upon. In the realm of biology the only resources which can afford us a little guiding light are (1) *morphology*, through a comparative study of related types, and (2) *embryology*, or the study of the individual life-history, in the course of which we find, among many parasites, characters reappearing which point back to an earlier, non-parasitic, phase of life.

As regards the evolution and causes of social parasitism, we have—apart from the biological methods of research, which are sometimes valid enough here also—more direct and certain means of information

in the written histories, and, better still, in the daily observation of social phenomena. More fortunately placed than the biologist, we find ourselves present at the birth of the parasitic mode of life, and are much better able to speak of its factors and growth.

(*a*) ORGANIC PARASITISM.

§ 1. *Evolution of Parasitism among Plants.*

Among plants, and among the Protists, or simplest forms of life—such as the Bacteria, which seem to incline to the vegetable type—parasitism is always derived from a holophytic or saprophytic mode of life. We shall illustrate this by examples taken at various stages of plant-life, from the Bacteria to the Phanerogams.

1. *Holophytic Parasitism.*—A few species of microbes are entirely self-supporting. Provided with suitable colouring matter, they are able to take their supplies of carbon directly from the atmosphere, and have a kind of life not unlike that of the holophytic plants. Some species (as *Bacillus subtilis*) are associated with the presence of organic matter, and live saprophytically; others again (as *Bacillus tetani*) become, in the course of time, adapted to the parasitic habit of life; while others, finally, can only exist as parasites

and are indebted for absolutely everything to the victim whom they infest. The tubercle bacillus may serve as the example of this final stage in the evolution of a habit which takes its origin from a holophytic mode of existence. Parasitism more complete it is impossible to conceive. For this organism is in the first case incapable of developing at all unless within its proper host. It draws its food-supply from the lymph and cellular substance of its victim, and is indebted to the blood not only for oxygen but also for the warmth that is a necessary condition to its continued existence, its adaptation to the temperature of the body it inhabits being so complete that it can hardly survive a transference. Nay, so thorough is its dependence that, powerless to move itself, it is indebted to the heart-beat of its host for the force which, carrying it along the blood-current, enables it to spread through the whole system.

2. The Algæ illustrate all the transitions from independent life to the most absolute parasitism. The reproductive cells of the Laminarians germinate indifferently on any solid bodies to which chance attaches them. Yet adult Laminarians are never found attached to other marine plants; those individuals who form such an attachment die young. These organisms are forbidden to be parasites, at the peril of their lives. Other Algæ, such as *Porphyra*, live indifferently

on rocks or on living things. Species of *Leathesia* are rarely found on rocks or the like, for they have difficulty in developing upon inorganic support. The parasitism here is one of preference—that is to say, of comparative facility—but the balance of advantage is quite distinct. To the genus *Myrionema*, again, no choice is left; these Algæ live exclusively upon other Algæ, but it matters little to what group the latter belong. Very different is it with *Elachista fucicola*, which can only live upon one genus (*Fucus*) though it is to be met with upon various species belonging to that genus. Another case of extreme specialisation in parasitism of support is presented by *Elachista sericea*, which lives only attached to *Himantalia lorea*, and receives from it, without doubt, more than half of its food-supply.

3. We pass now to phanerogamic plants. The Scrophulariaceæ include, along with the holophytic tribe of the Antirrhineæ, another tribe called Rhinantheæ, which usually fix their roots to those of grasses, and are therefore to be considered as optional or facultative parasites. Within the neighbouring family of the Orobancheæ, all the species are essentially parasitic, and have therefore ceased to possess leaves or ordinary soil-roots, these organs being unnecessary for their mode of life.

4. An analogous series is presented by the family

of the Convolvulaceæ. Thus *Convolvulus soldanella* takes nothing from its neighbours. The bindweed of the hedgerows is a parasite of support, being indebted to the shrub for the power to carry its leaves and flowers upward, where they may spread in sight of the sun, its own frail stem being unequal to the burden. In a neighbouring genus, the dodder, we have one of the most extraordinary instances of parasitism in the whole world of plant-life. This parasite, like its relative the bindweed, fixes itself to some other plant, especially to clover; but it asks more than the mechanical services of a bearer. Its stem is equipped with suckers, which it presses into the living tissue of its victim, and thus completely drains the life of the latter. When its host dies, the dodder stretches out its flexible branches and fastens upon the nearest new prey. It is thus that there come to be formed in fields of clover the well-known "witches rings," the inner area of which is covered with dead plants, while round the circumference the dodder goes on attacking the plants which have not yet been destroyed.

To resume then, in the examples above described—which might easily be multiplied—a study of comparative anatomy furnishes us with a whole series of connecting stages, through which the most markedly parasitic species must necessarily have passed. These stages are: complete independence, as seen in those

Bacteria which are provided with suitable pigment, the Laminarian Algæ, the Antirrhineæ, and certain *Cuscuculi*; parasitism of support, as seen in *Porphyra* and *Myrionema*, as also in the bindweed; lastly, every degree of nutritive parasitism, from the facultative and unpronounced forms on to the most destructive and the most rigorously specialised. And as there can be no doubt that the primitive mode of life of all these groups was one of complete independence, this series of extant structural modifications clearly recapitulates for us the historical evolution of the parasitic habit.

The transition from holophytism to parasitism is still more obvious in the teratological phenomenon known as variegation. Upon the leaves of many plants, especially Japanese ones, there are areas entirely devoid of chlorophyll. The cells of these colourless parts are therefore incapable of effecting the organic synthesis characteristic of plants; *i.e.*, they are incapable of absorbing carbonic acid from the air, splitting it up by the aid of the radiant energy which passes through the green colouring-matter, liberating the oxygen, and retaining the carbon as the basis of new organic compounds. They are therefore compelled to exist as parasites upon the green parts of the plant. This chlorosis may even extend to a whole branch; in which case the helplessness of this part is shown

readily by the fact that a cutting made from it cannot live. Be it observed, however, that in such cases of variegation we have to deal not with one individual living at the expense of another, but merely with a group of cells which makes the rest of the colony minister to its necessities.

1. *Saprophytic Parasitism.*—It is in the Fungi that we can best observe the transitions from the saprophytic life to the most specialised forms of parasitism. Most of them, especially the Mucedineæ, are exclusively saprophytic in habit, and take their food-supply from the waste products or the dead bodies of other organisms, either plants or animals.

Certain species of *Botrytis* live at the expense of living plants, but are incapable of successfully attacking one which is completely healthy. They always begin by installing themselves in a cell which has perished for some reason or other; and taking this as their base of operations they extend themselves and carry death to the cells around.

2. Other Fungi (as, for instance, the rusts or *Uredineæ*) are completely parasitic, and cannot exist otherwise. Among some of them this character reaches such a degree of specialisation that not only are they rigorously adapted to hosts of a particular species, and to that alone, but they are even dependent for their perfect development on a series of

migrations analogous to what we find in the case of the tape-worm. This is notably the case with the mildew of wheat, whose life-history is now well ascertained.

Towards springtime the large spores of this fungus, having wintered underground, begin to bud and give off very light spores, which the wind scatters in every direction. If these are to escape destruction it is absolutely necessary that they shall succeed in fixing themselves to the leaves of one particular shrub; that shrub is the barberry. And if this condition be not realised, the cycle is arrested; if, on the other hand, chance favours them, these spores install themselves upon the plant chosen by their species, and begin their parasitic career. They soon develop a vegetative structure, which gives rise to reproductive elements of an entirely different character. These are totally unable to germinate upon the barberry, and must, if they are to develop at all, get into contact with the leaves of some cereals, on which they appear in the form known as mildew. In this new phase of existence spores of a fourth kind are formed, which carry the blight to the cereals around. Finally, with the coming of autumn, a last metamorphosis takes place; for the mildew now produces large spores with hard walls, whose destiny it is to reinaugurate next year this protean series of transformations.

§ 2. *Evolution of Parasitism among Animals.*

1. The critical methods of embryology and of morphology alone are in most cases sufficient to establish the fact that among animals proper—which are characteristically predatory organisms—the parasitic mode of life is nearly always derived from a previous predatory one. This appears to be true also of those Protists (or simplest living forms) which incline rather to the animal than the plant type.

Among the suctorial Infusorians we find a number of comparatively large species which feed upon smaller forms, and are, therefore, truly predatory. Others are hardly larger than the organisms which they absorb; and as soon as they have fed they encyst themselves, and multiply by subdivision. Others, again, being very small, are able to work their way into the substance of the larger Infusorians, and there they encyst and subdivide during the lifetime of their host. The young *Acinetæ*, which result from this multiplication, have motor cilia, and present the ordinary appearance of predatory Infusorians. Anatomy and physiology corroborate the indications thus given by embryology, and all agree in supporting the theory that the parasitic form of life in these cases has been evolved from the predatory one.

As to the larger animals, it will be sufficient if

we take some characteristic examples from among the crustaceans and the gasteropod molluscs.

(1) All crustaceans are originally predatory animals. The study of the life-history of even such species as are actually found living parasitically (*Sacculina*, Bopyridæ, Lerneæ, etc.) makes it clear enough that they were predatory to begin with. The individual life-history recapitulates that of the race, and we find those creatures living in their youth a free life and then exactly resembling in form young stages of the predatory species of the group to which they belong. Moreover, among some of them the male continues this free life and retains all the characters of his order, while the female settles into immobility and, through the deforming influence of sluggish life, ends by becoming little more than a sack full of eggs.

The older naturalists who first gave attention to those strange creatures only recognised them in their state of adult deformity, and consequently classed them among worms. It was not till a comparative study of the earlier life-stages had been made that their pedigree was ascertained and their true place among crustaceans recognised.

(2) The gasteropod molluscs are for the most part herbivorous or carnivorous; but a few species live as parasites upon Echinoderms. Such, for instance, is the *Entoconcha*, a small animal of a brownish yellow

colour, living within the transparent body of the Holothurian *Synapta*, and feeding on its blood. Like all ento-parasites, *Entoconcha* is an extremely degenerate organism, so that the anatomy of the adult gives absolutely no clue to its systematic position. It is only by tracing the early life-history that we are able to discover that here we have a "prosobranch" gasteropod mollusc which has been metamorphosed by a parasitic career. Its ancestors had undoubtedly a protective shell and a well-developed nervous system. We find these characters in an embryonic state in the larvæ of *Entoconcha* and even persisting in the adults of certain species belonging to this group, which illustrate the whole series of transitions from free life to parasitism.

Capulus is a parasite of support which attaches itself to Crinoids and lives upon their digestive waste-products. Next to it comes *Thyca*, which buries part of its body in the outer coating of its Asteroid host. Then *Stylifer*, which has almost completely disappeared into the substance of the sea-star which bears it. Then *Entocolax*, which penetrates into the tissues, and is, therefore, virtually an endo-parasite; nevertheless, it still remains fixed by its hind extremity to the outer wall of its host. Lastly comes *Entoconcha*, which is absolutely endo-parasitic, and fixes itself by its head-end to that part of

the vascular system which runs along the digestive tube of its host.

All these animals possess in youth the characteristic shell of the gasteropod, which is in itself sufficient proof that they are all derived from non-parasitic types.

2. *Mutualist Parasitism.*—We do not know of any indubitable cases in the organic world where parasitism has been derived from a previous mutualist relation. Indeed, the mutualist relation is rarely met with except in social groups—among men and certain animals, such as bees, ants, beavers—where it is or tends to be the norm.

Still, it sometimes happens that the fairly well-defined relation of mutualism existing between plants and insects degenerates into one of parasitism on the part of the latter. Thus the humble-bee, which alone is able to fertilise the flowers of the toad-flax, often contrives to steal their nectar without rendering them any benefit in return. The fertilisation of the toad-flax is brought about in the ordinary way, by the pollen of one flower being carried away by an insect and left upon the stigma of another; and in order to attract this necessary go-between, the flower secretes nectar. But in the toad-flax the neck of the corolla is completely closed up by a protuberance of the lower lip, and it requires a heavy insect like the humble-

bee to rest on this in order to press it down and give access to the nectary. Then, while the insect sucks the nectar, its back becomes powdered with pollen, which it afterwards deposits upon the stigma of another flower of the same species, which it has visited for a fresh repast.

So far, there is reciprocity of services, for the flower has need of the insect. But very often the humble-bee finds it more convenient to pierce through the wall of the nectary from without, and so sucks the honey without fertilising the flower. In proportion as this becomes habitual, the humble-bee ceases to be a mutualist, and becomes no better than a parasite.

(*b*) SOCIAL PARASITISM.

In the evolution of social parasitism the point of departure may be taken from modes of life corresponding to those which we have enumerated in the organic: from holophytism or saprophytism, from rapine or from mutualism. That is to say, social parasites may be descended from, or may themselves have begun their career as, either predatory foes of society, or mutualist workers, or individuals producing directly from the store-house of nature all that was necessary to their scheme of life. We shall now

proceed to verify the evolutionary process in these different groups.

§ 1. *Evolution of Parasitism in Social Groups which derive their Means of Subsistence directly from Nature.*

In lowly-organised communities the majority must necessarily gain their livelihood either by hunting, by fishing, or by gathering such food and other supplies as are to be had for the picking up; and the number of parasitic and predatory persons must be limited by the number of individuals of whom it is possible to make a prey. Still, among savages, as among those civilised groups where intermediary professions abound, the transition from one mode of life to another is both frequent and rapidly made. The Fuegians, who ordinarily live upon shell-fish, become necrophagous when a whale gets stranded on their shores, and will even, in times of scarcity, revert to cannibalism. The Bosjesmans, who eat ants, wild fruit, and carrion, lose no opportunity of changing to the parasitic state and living by plundering the Kaffirs, the Hottentots and the white settlers. Just in the same way, a *gamin* of our streets here in Brussels may be almost simultaneously a parasite (when he practices larceny), a mutualist (when he takes a turn at going errands), then immediately

thereupon a sort of social saprophyte (when he gives himself to the gathering of cigar ends), or a holophytic individual when, reverting to more primitive habits, he betakes himself to the forest of Soignes to find whortle-berries in spring or to gather beech-nuts in autumn.

But to observe the transformation of what one may call social holophytism into social parasitism, we must turn to the communities whose organisation is more stable than that of these very primitive ones can be. Then, indeed, we find ourselves quite embarrassed by the innumerable wealth of examples; for instance, if we wish to describe the changing of a self-supporting husbandman into a parasitic proprietor, living at the expense of a greater or less number of workers. It need hardly be said that examples quite analogous could be found in the history of fisheries and of the extractive industries.

In the history of the Roman people we have what may be considered the classic example of a community which begins with an agricultural, self-supporting mode of life, and ends by being altogether parasitic; the populace fed on the corn of the provincials, and the rich exploited by the labour of regiments of slaves, those vast farms or *latifundia*, of which they could not have beat the boundaries even on horseback if the caprice had taken them to do so!

Still, this transformation in the economic character of the Roman people was largely determined by those wars of conquest which fill the annals of the Republic from start to finish. Our purpose will be better served if we seek our examples on virgin soil and in the colonies of the New World, where the same factors were not at work, but where, nevertheless, proprietorship, due to personal labour in the first instance, degenerates more or less rapidly into sheer parasitism.

The emigrant who clears a space of ground in the far West gets from the soil, without anyone's help, just a livelihood and no more. As long as land remains free, men also remain free, and they refuse to pay rent to other men for the ground they live upon. So Parkinson, Strickland, and all the Europeans who visited America in the eighteenth century were astonished to find that in this strange country capitalistic proprietorship could not get a foothold. How different the order of things is to-day everybody knows. The land is occupied right to the prairie verge, vast centres of population have been formed, and the newcomer who is not provided with other resources must work for wages in the city, or rent a farm, or become a farmer's man. At this stage, if the original owner continues to occupy himself in agricultural pursuits, there is still, to a certain extent,

an exchange of services between his helpers and him; although, thanks to his hold upon the land, he keeps to himself even now the lion's share of the benefit. Mutualism ends when absenteeism begins, and in most cases parasitism quickly takes its place. It continues to become more marked—always supposing that the proprietor of the land renders no benefit in other ways to society—in proportion as the population is increased, as rural property is changed to urban, and as agriculture is displaced by industrialism. The evolution of the proprietary regime in the United States, as described to us by Henry George, is producing in the most natural way exactly the state of things that prevailed in the Roman Empire, where six monopolists owned among them one half of the whole province of Africa; or that now prevails in the British Islands, where by means of sanguinary acts of expropriation (of which the history has been traced for us by Karl Marx) the greater part of the land has been concentrated in the hands of a few families—half of England and Wales belonging to 4,500 persons, half of Ireland to 744 persons, and half of Scotland to only 70!

The proprietary parasites—*corruptio optimi pessima*—are all the more mischievous because they create a world of parasitism around them; and because they themselves, when they find their revenues insufficient

for their needs, are undoubtedly apt to betake themselves to immoral and illegitimate ways of increasing their income. Some take to betting and play, or gamble on the Stock Exchange, or become speculators of a more or less suspected kind. Others use their wealth for purposes in which most of their own class do not care to imitate them, and therefore, competition being feeble, their profits are very considerable. Such is the case, for instance, of those who, with a purely mercenary aim, build workmen's quarters in towns. Few investors care to exploit this miserable clientele, and therefore those who are not above doing so are rewarded by exorbitant rents. Still more marked is the parasitic character in those among them who transform their property into "houses of tolerance" (brothels recognised by the authorities), thereby reaping a yearly return of 30 to 40 per cent. on their capital. In 1870, there were in Paris 143 houses of this class. Of those, 22 were really the property of the persons carrying on the exploitation, 24 belonged to individuals engaged in other pursuits, and 97 to "persons of independent means" (*rentiers*). There, surely, we have a striking example of the manifold points of contact that tend to exist between the various modes of parasitism!

§ 2. *Evolution of Predatory Parasitism.*

The transformation of a race of predatory exploiters into a race of parasites—that is the whole history of the Arab tribes of the Moghreb. Their method is at first purely and simply the destruction of the populations that resist their inroad, a predatory *razzia* such as occurs still in the forests of the Upper Congo. Later, we find them mapping out the whole of an oasis into allotments, and leaving the inhabitants to work as tributary cultivators—swooping down upon these victims of exploitation at harvest time, lifting their tribute of dates, and going off on their camels to the desert again. To-day, having been driven back by the French occupation, the Sahara tribes live as best they may by attempts at pillage, and by smaller acts of plunder. Others, equally incapable of adapting themselves to the conditions of life among Europeans, form parasitic settlements on the outskirts of the large towns. At the gates of Constantine, for instance, you will find a huddled-up mass of *gourbis*, displaying a condition of wretchedness and filth compared with which our own slums must appear quite sumptuous phalansteries. Here are collected the remnants of tribes that have been broken-up, displaced and ruined by conquest, those unfortunates whom the cultivators call *Ben-ramassés*, and who have no means of livelihood

save begging, prostitution, and every variety of crime.

In this instance, then, the parasite is a predatory exploiter whose strength has been broken, who cannot maintain his former character in the presence of a changed environment. We can still observe in him, as M. Tarde has pointed out, the successive stages of his degeneracy, from the wholesale stealing of flocks in the Barbary wars to the chance theft of a chicken in the country places, which is daily achieved by somebody. Everything has grown meaner, the object of the theft and the social quality of the thief. But still at bottom the act remains the same; and still in our days, "in the most civilised regions of the world, the lifting of a horse from its stable, or of a couple of oxen from their stall, has about it a certain archæological colour which forbids us to confound its perpetrator, be he Bedouin or bandit, with the common thief."

Another and a most typical example is also supplied by M. G. Tarde in his "Archèologie judiciaire du Périgord"—a work based upon a study of the contents of the archives of Perigord dating anterior to 1789. He points out how, in proportion as the political organisation of France became consolidated, the private wars so prevalent in the Middle Ages (which

were simply instances of predatory exploitation, gradually changed themselves, because they needs must, into offences against the common law; so that M. Tarde asks "whether our present-day burglar, that specialist who disfurnishes villas or town residences whose occupants are from home, ought not to be looked upon as the latest *avatar* of these feudal worthies who were so great at disfurnishing other people's castles and chateaux, and who, after being metamorphosed for a time into great land-owners of a more or less thievish propensity, have now made their final appearance as criminals of a more or less vulgar stamp and status?"

Whatever be the worth of this hypothesis—and some very curious documents go far towards bearing it out—we may at any rate regard it as certain that the anti-social parasite, the professional delinquent—really a child of savagedom astray in society—is connected by direct lines of filiation with a bygone practice of predatory exploitation. In some cases, perhaps, the actual fact is due to atavistic attraction: more often, certainly, the re-appearance of criminal habits is due to imitation; but in every case we can say that parasites of this category are predatories whose natural power is weakened, or whose characteristic action is hindered by the organisation of modern society.

On the other hand, there can be no doubt that the predatory type of parasitism is often developed from a mutualist relation of the parties. This occurs, for instance, when a banker becomes transformed into a usurer or a jobber on 'change.

§ 3. *Evolution of Mutualist Parasitism.*

We have designated as *mutualists* all those who get their means of existence from other workers in exchange for various kinds of service rendered: the manufacture of products, personal services, public duties, etc. From all these forms of mutualism corresponding forms of parasitism may take their rise. We shall illustrate the process by a few examples.

1. *Manufacturing Industries.* — The "industrial class" first really begins to exist at the moment when economic production ceases to have its centre in the home, whether the members of the family work upon the first product (raw material) themselves, or have this done for them by slaves or by persons working for day-wages. As soon as those engaged in elaboration come to possess raw material on their own account, we have the beginnings of movable as distinguished from fixed (or landed) property,—the beginnings of a new system of social and political rights, which by and by becomes embodied in the middle class or bourgeoisie. And at first the mutual-

ism is complete and pure; the artisan, bound to his means of livelihood "like a cockle to its shell," is dependent upon no man, and holds no man in dependence upon him. But the mutualism suffers a change when the extension of the market brings into existence two new modes of exploitation — domestic industry *(l'industrie à domicile)* and the factory system *(l'industrie de fabrique)*.

Domestic industry, being without power to affect control of the productive process, can only arrange for the *sale* of goods. The workers, for the most part old artisans or peasant families, no longer produce for the consumer directly, but for a single buyer, who acts as middleman. As they are scattered over a wide area, and are without knowledge of the state of the market, he finds it easy to keep them completely dependent upon him. Often, however, he is not content with that, but has recourse to additional means of rendering his exploitation more drastic. Usury, for instance, in every imaginable form; by lending small sums of money for short periods at exorbitant rates of interest (*le prêt à la petite semaine*), by supplies given on credit at exorbitant prices, advances of various sorts made on the most ruinous conditions, and payments in kind according to a monstrous table of values. These are a few of the methods employed both by the dealer himself and still more

by the subordinate agents who act between him and the workers. The inquiry into the sweating system in London, the works of M. du Maroussem on the furniture-trade, M. de Greef's book on the lace-trade, and the numerous monographs which have been published in Germany, Austria, and other countries, on the various forms of domestic industry, all contain well-authenticated accounts of the doings of those voracious parasites who over-run the whole land, questing out the worker wherever he is to be found, in public-house or garret, and whose whole activity has but one aim and object—to falsify, for their personal gain and that of their master, the natural laws of the distribution of wealth.

In the factory system the evolution towards parasitism goes its way in open daylight, and under a variety of forms. In proportion as the extension of the market calls for an increase in the scale of production, the more marked becomes the separation of the wage-earners, who are engaged in the actual work of production, from the capitalist master, who retains to himself the task of direction alone. Then comes the moment when those captains of industry delegate their functions to lieutenants, reducing their personal interference in the business to a minimum. One step further and we have the parasitic condition fully achieved; on the one side *work and no property*, on

the other side *property and no work*. Then the workers do not even know who the capitalists are by whom they are exploited, and the exploiters have perhaps never even seen the industrial black-hole or factory of which they are the shareholders.

2. *Personal Services.*—To describe the transformation of personal services into parasitism we shall take, from among the many available, those two most striking examples—the *clientage* of Rome and the *court officialdom* of France under the ancient regime.

In his account of the household of the King of France, M. Taine tells us that at the head of the servants properly so-called—an army of 14,000 men, absorbing a tithe of the entire public revenue—there were a certain number of high and mighty seigneurs, hereditary holders of offices which had gradually assumed the character of lucrative sinecures. There were, "Premier Master of the King's House, the Comte de Cars; Premier Master of the Pantry, the Duc de Brissac; Grand Master of the Wardrobe, the Duc de la Rochefoucauld-Liancourt; Grand Cup-Bearer, the Marquis de Verneuil; Grand Carver, the Marquis de la Chesnay." A glance at the titles of such offices shows that the parasites actually holding them had taken the place of former companions of the king, servants who were in his confidence, and were wont to render him real personal services.

The history of clientage throughout the whole course of Roman history illustrates all the stages between mutualism and parasitism.[1]

At first the tie between client and patron was of a very permanent kind, being an hereditary obligation on the part of each family to offices of mutual good-will and service.

Towards the close of the Republic the class of clients proper had grown very small in number, being by this time mainly represented by freedmen, who were originally only one variety of client. What was called clientage in the time of the emperors was a new institution passing under an old name, which was in some respects appropriate enough, however. In the times of the Republic every man who aspired to take part in public life had found it necessary, both in order to acquire influence and to assure it when acquired, to gather around him a cortege of docile creatures—*salutatores, deductores, assectatores*—whom he attached to his person by benefits, flattery, and largesse, and from whom he expected a return in the form of help and support, especially when he became a candidate for any public office.

Under the empire such followings no longer had any political meaning or reason for existing. But,

[1] See "Mommsen and Marquardt's Handbook of Roman Antiquities," Humbert's (French) trans., vol. xiv., p. 239, etc.

none the less, outstanding personages still found it necessary to show themselves in public surrounded by an imposing escort, and to give their dwellings the appearance of little courts which they held by means of protection given in return for favours bestowed. Nor was it difficult for them to recruit these forces; for your true Roman had a notable distaste for every kind of humble and honest bread-winning, had always need of a large scale of life and a sense of influence. Therefore, many members of every rank asked nothing better than to be able to attach themselves to one of the great houses, and thus secure an income without labour, as well as a recognised social status.

Mommsen and Marquardt, from whom these facts are taken almost verbally, give the whole catalogue of these parasites. Side by side with poets, soldiers, and even men of consular rank, there were "fellows out of employment, always on the move, and ready to take in hand any good or bad job for a consideration, professional sharpers, ragged beggars down at heel, persons on the quest for a good dinner, and, in fact, everybody who considered it convenient and respectable to live at the expense of a person of quality, subsisting partly by his friendly interest and partly by direct bounty in the form of alms." Sometimes the patron admitted these dependents to his table, but generally he was content with remitting to them their

sportula. This was originally a portion of the repast which the client carried to his own home, but in later times the term stood for a small sum of money wherewith the hanger-on was to buy his own rations.

3. *Public Offices.*—Traditional parasitism, the survival of certain offices after the necessary conditions that created them have ceased to exist, is to be found quite as unmistakably in animal communities as in human society.

In ant-hills it is not uncommon to find Myriopods, Staphylinid beetles and other Arthropods, which have become completely blind through living in the darkness of the earth-heap. They undoubtedly live as parasites of the ants, to whom they render no services whatever. How comes it, then, that the ants tolerate their presence? Although the fact is not yet proved, it is, at any rate, very likely that at an earlier period there had subsisted between these species and the ants some kind of mutualist relation analogous to that which still exists between ants and aphides. Little by little this relation has ceased, until the animals found in ant-hills to-day have become traditional parasites, tolerated through the inertia of custom, on account of the services formerly rendered by their ancestors.[1]

[1] From a conversation which we had on this subject with M. Giard. [See also Wasmann's "Verzeichnis der myrmecophilen und termitophilen Arthropoden." 1894.—*Tr.*]

Now this is exactly what happens when public offices, which formerly answered to a real need, become gradually transformed into expensive sinecures; society tolerates them out of habit and from a repugnance to change.

It is among ants, indeed, that we find perhaps the most striking known example of this kind of parasitism. Their societies, as is well known, sometimes present a fairly high degree of complexity. In some of their cities the Amazon soldiers have handed over to slaves belonging to a different species the duties which are considered "inferior." Here we have a rough sort of division of labour, more or less analogous to that presented by feudal society, where the lord went forth to fight and the serf to labour. But what is most curious is that in certain species (such as *Strongylognathus testaceus*, studied by Forel) a spell of inactivity, prolonged, from some cause or other, through several generations, has ended in rendering the ants of the aristocratic classes quite incapable of warlike exploits. Mere caricatures of their ancestors, they have not yet lost their bellicose instincts: but when they go forth to battle their feeble strength proves traitor to their valiant hearts! They fairly collapse in their efforts to carry off the pupæ which they have conquered; and would never succeed in doing so at all did not the slaves, who accompany

them on their expeditions, come to their aid, and shoulder the booty with the greatest ease. Suppose the process to proceed one step further, then those Amazon ants would be reduced to a condition of complete parasitism, owing their subsistence entirely to their slaves, in whom the traditional instinct of servitude would continue operative.

If we now turn our attention to human societies, we find a striking analogy between the condition of affairs just described and that which existed, say, in France under the old regime. There the noblesse, while retaining a multitude of privileges, had become entirely dispossessed of governmental functions. In early times the seigneur united in his own hands every kind of power and function; he was civil chief and military leader, establishing imposts and administering justice, protecting the land from the incursions of robber bands as well as from the devastation of the fallow deer. Little by little these local potentates were replaced by the central government, as its departments were successively organised. The agents of the king stripped the seigneurs of their prerogatives, but left them the empty titles, and the handsome salaries annexed. Thus, alongside of the government proper, the ancient organisation of society still persisted, and was, naturally, a swarming ant-hill of parasites. The feudal rights which formerly

had been real "duties" attaching to land, movable property, or personal relationship, now became mere levies, mere appropriations of a share of the produce, corresponding to no service whatever. The peasant continued to pay the old dues of "*Guet et garde*,"[1] of "*Poursoin*," and of "*Sauvement*,"[2] as the price of a protection which he no longer needed. Everywhere the real governor of the district was the intendant. "The titular governor was there only to entertain guests, and even that he could not do without permission, since he had to ask leave to go and reside in his government." Formerly the Game Laws had been to the benefit of the peasant; now they were a grievous charge. "The masters of the hunt (*capitaines de chasses*), the huntsmen, keepers, and other underlings, protected the beasts under their care as if they had been human beings, and hunted human beings as if they had been beasts." The four hundred areas into which the country was divided and placed under the rule of these district masters of the hunt were quite over-run by game, both large and small. In a word, a class of persons who had at one time exercised

[1] "*Guet et garde*," a feudal obligation upon the vassals to watch and ward the chateaux of their superiors. Later it was changed into a money tax.

[2] "*Sauvement*"—in consideration of his maintaining in repair the walls of the town, the seigneur had a right to levy half a tithe of the vine and wheat harvest.

real social functions had now become a social nuisance. "Equally careless regarding the government of the country and the management of their own affairs, they left the one entirely in the hands of the provincial intendants, and trusted for the other to their private intendants, the stewards of their own estates."

In our own day, survivals of this sort are rarer, and find it increasingly difficult to hold their ground. Hereditary offices, monarchy excepted, have almost disappeared. Such sinecures as do exist affect, at least, an appearance of utility, in order to escape the animadversions of public opinion and of the press; and if parasitism is still in evidence, it now renders to the workers the homage of hypocrisy. At most you will find that within our modern institutions certain offices which have become obviously useless are still allowed to exist technically to the extent of not being legally abolished, but that when they fall vacant, they are no longer filled up. Such, for instance, is the office of public executioner here in Belgium, an office which continues, although capital punishment has been discontinued in fact, if not abolished by law; or that of the councillors of mines, who no longer meet, and whose numbers have shrunk, by successive decease of members, to two-thirds of the proper complement. Similar bodies are in England, the

corporations of London,[1] and in Scotland the convention of royal burghs. Once upon a time possessed of municipal legislative powers, they still meet once a year and maintain their traditional organisation with the most jealous care, though they have long ceased to exercise any function whatever.[2]

§ 4. *Summary and Conclusions.*

To sum up, then. Social parasitism may have two points of departure, diametrically opposed one to the other. It may be developed from a state of *predatism* or from one of *mutualism;* the latter word being understood in a very wide sense, as describing all the modes of livelihood which are neither useless nor hurtful to other individuals.

Predatory parasites are organisms which have been vanquished in the struggle for existence, have become powerless to destroy the individuals or the classes upon whom they waged war aforetime, and must now be content to exploit the working-power of those whose energy is greater than their own.

Mutualist parasites, on the other hand, are those who have adopted the parasitic rôle for the sake merely of

[1] [This indictment cannot be accepted as proven.—*Tr.*]

[2] Spencer: "Sociology," iii., p. 345. [It may be said, however, that these bodies have consultative or deliberative functions. They focus common interests and have some corporate influence.—*Tr.*]

an easy life, and who manage, thanks to services once rendered by their ancestors, to secure a living without working for it.

Between the predatory and the mutualist types there are certain intermediary classes of parasites, consisting of members whose "development" may vary greatly. This is the case, for instance, with sexual parasites. The ranks of prostitution are recruited quite as much from among underpaid work-girls, driven to this resource by the wretchedness of their condition, as from among girls whose natural tendencies and family history class them rather with the predatory order of parasite. Similarly with those proxenetes who trade upon the debauchery of the prostitutes. The keeper of a licenced brothel (*maison de tolérance*) is akin to the proprietary parasite, while the "*ponce*," or bully, who lives upon the earnings of a prostitute mistress, is generally a member of the criminal classes.

But in every case a final analysis brings us back to change in the environment as the prime cause of parasitism. The increasing organisation of society creates a social medium unfavourable to the openly predatory, and constrains their descendants, and those who would live after their way, to betake themselves to parasitic methods. And again, when existing institutions cease to correspond to a real social need, the

preservation of them as survivals in the general political or social structure of the country inevitably breeds a swarm of parasites.

It should be noted that the evolution towards parasitism is not irreversible. So long as we have not to deal with organic degeneracy, we may make it possible for the social parasite to return to mutualist relations with his fellows. Still more possible is it, however, for him to turn to account a favourable moment, and revert to the predatory character and practice of an earlier time.

CHAPTER III.

Influence of the Parasitic Life upon the Parasite.

There are three sets of modifications arising from the adoption of a parasitic mode of life:—(1) *Atrophy of organs no longer useful;* (2) *Development of new characters or adaptations;* (3) *Change in the reproductive function.*

§ 1. *Atrophy of Organs no longer useful.*

Whenever it happens that an organism ceases for a length of time to exercise a particular activity or function, it follows as a consequence that the organ identified with that function tends to atrophy. If a limb be broken, the prolonged subsequent disuse of it brings on a partial degeneration of the muscles of that region. This phenomenon assumes a very definite character in cases where the disuse has become permanently established. Take the case of the Cetaceans (whale, porpoise, etc.), mammals which have adapted themselves to pelagic conditions of life. Swimming being effected by means of tail and fore-

limbs alone, the hind limbs have disappeared through want of exercise; and no trace of them remains, save a portion of the skeleton that happens to support certain muscles that have remained in functional obscurity.[1]

The explanation of this atrophy—which, as we shall see, is also a characteristic of parasitism—is to be sought in the operation of the law of natural selection, favouring the survival of the fittest—that is to say, the best adapted to their environment. We may say that a disused organ becomes a parasite upon the organism as a whole, just as we say that those parts of a "variegated" plant which are destitute of chlorophyll are parasitic in relation to the green parts. Now, as soon as an organ becomes a surcharge upon the resources of the organism, that organism is handicapped in the struggle for existence. Consequently, the atrophy of the organ in question is a distinct gain, which natural selection tends to make permanent. Variegation, we find, is not hereditary.

This cause of atrophy acts with exceptional force among parasites. These organisms live in precarious conditions; and, if they would not kill the goose that lays the golden eggs, they must exact from the host on whom they impose themselves no more than the

[1] [This theory of disappearance of structures through disuse is, however, in most cases, an interpretation, not a demonstrated fact.—*Tr.*]

amount of nutrition that is necessary. Consequently, useless organs may be a more dangerous surcharge to parasites than they would be to organisms living an independent life. So we find that atrophy is both more rapid and more complete among parasites than elsewhere. Plants lose their roots and even their leaves. Among animals, the points of contact with the world are minimised in proportion to the degree of parasitism; the nervous system tends to disappear, so completely, indeed, that in some species the individual ends in being little more than a sac with reproductive organs.

In the world of human life, parasitic degeneration is, above all, cerebral. The intellectual faculties are the first to atrophy from disuse; physical degeneration is a later and almost a reflex process. We have already said that the less effort a parasitic organism needs to put forth in order to secure its food supply, the greater will its degeneracy be. Upon this principle, we ought to find the maximum of degeneracy among sinecurists and the propertied classes. But it must not be forgotten that these inherit, for the most part, a better constitution than the predatory parasites, that they live in a more favourable medium, and that, moreover, only a very small proportion of them are totally without intellectual interests of one sort or another.

At any rate it is certain that within the compass of

a given group the degeneration increases in proportion to the degree of sluggishness. The women who are on the staff of a house of prostitution are much inferior intellectually to the scheduled women *(filles en carte)* who carry on their avocations on their own account; still more so to those who practice this profession clandestinely. The latter have naturally to exercise more ingenuity in order to gain new clients, to elude the surveillance of the police, and in many cases, also, to provide themselves with means of livelihood other than prostitution.

§ 2. *Development of New Characters or Adaptations.* The modifications of this nature that may occur in an organism grown parasitic may be either (1) *Acquisition and elaboration of means of attack appropriate to their mode of life*, or (2) *Development of new secondary characters in keeping with the change of environment that results from the parasitic life.* We shall speak of the latter first, as—

1. *Secondary Adaptations.*—These are explained simply enough. It is self-evident that if parasitism brings about a transition into a new environment, the parasitic organism must adapt itself thereto; and necessarily acquires certain new characters, which need not be of any direct use to it so far as the exploitation of its victim is concerned.

The son of a well-to-do family who goes up to town to consume his father's revenues; the country girl who, tired of tending turkeys, goes also to town, and becomes an elegant young person of easy-going virtue; the Arab nomad who strikes root in the purlieus of Algiers or Constantinople; the squireen who forsakes his fields to go spend at court the income made for him by his peasantry; in a word, all those who change their environment on becoming parasites take on an appearance very different indeed from that which they would have displayed had they remained in their old habitat. This transformation becomes especially well-marked when a conquering race installs itself in a country which it has subdued, and takes to living parasitically upon the conquered population. The descendants of the Manshoos, who let their nails grow till they resemble corkscrews in order to mark their horror of manual labour, have little likeness to their ancestors, those hordes of fierce warriors who swooped down from the high plateaux of Central Asia.

This is true also of the animals which become endo-parasites, and of the plants which become epiphytic.

When a plant, ceasing to draw its own nourishment from the ground, installs itself upon the branch of a tree, it must, under penalty of death, acquire new characters which shall enable it still to secure those

supplies of water and mineral substances which its congeners get for themselves directly from the ground. It is somewhat in the condition of plants rooted to rocks or other substrata, where it is difficult to get supplies of water or nutritive salts. Consequently, we find among epiphytic plants a variety of characteristic modifications, making it possible for the plant to absorb water and store it for subsequent use.

Among the epiphytic Bromeliaceæ, notably, the base of the leaf forms a little pit or crevice, into which are collected not only supplies of water but also the droppings of birds, dead leaves, and other waste matters, which gradually decompose and break up into their original inorganic elements. According to the measure of its needs the plant draws from this storehouse, or rather this open drain, those food-supplies which the non-epiphytic Bromeliaceæ—which are without this adaptation—draw directly from the ground.

Among animals, the Remora affords a characteristic example of those secondary adaptations which are due to the parasitic life, indeed, but which in no sense directly facilitate the exploitation of the organism preyed upon. Nearly all fishes have the back or upper surface dark-coloured, the under surface being white. In this way it is rendered difficult for an enemy to spy them from above against the dark background of the depths; while if

he looks from below he sees them just as indistinctly against the lucid waters overhead in which they move. On account of its adoption of a parasitic life, the Remora presents an exactly inverse adaptation. As it attaches itself to the shark by means of its first dorsal fin (transformed into a sucker for the purpose), its belly or ordinary lower surface would show very clearly if it were white against the dark skin of the shark, and the animal would find itself made a dangerously distinct mark in the eyes of its enemies. Consequently, the belly has become very dark in colour, to match the skin of the shark, and the dorsal surface has become light.[1]

Similarly the parasites of pelagic animals, even though they be originally creatures of a littoral habitat, have all lost their original colours. They imitate their hosts, taking on the white or dark-blue colours of the medium in which they live, and thus eluding the notice of the organisms which pursue them as prey.

2. *Means of Attack—(a) Organic Parasitism.*—The adoption of a parasitic life by an organism necessitates the acquisition or the elaboration of means of attack appropriate to the new mode of existence. Only, it goes without saying that in the biological world this

[1] [It is possible to put another interpretation on the colouration of the Remora.—*Tr.*]

evolution of adaptations is necessarily a very slow and gradual process, operating through an innumerable series of generations; and that it is not possible, therefore, to describe with certainty its successive steps or phases. Only among microbes do the generations succeed one another so rapidly as to make possible an experimental study of the perfecting of means of attack.

Thus we know that it is easy to give any animal an "immunity" against certain species of microbes, to make the guinea-pig, for instance, indifferent to the attack of the microbe of Metchnikoff. Now it has been proved that if we take a guinea-pig that has been thus vaccinated, and inoculate it with microbes of a certain degree of virulence, the powers of attack which those microbes have are perfected in the sense of becoming more and more virulent. For if we take some of them from the body of this guinea-pig after the experiment has lasted a few hours, they will cause the death of a new guinea-pig in much less time than microbes taken direct from the original solution would have required.

The fact is explained by a hypothesis in line with the theory of natural selection. It is supposed that only the most virulent of the microbes succeed in holding their own against the leucocytes, that their superior virulence is hereditarily transmitted, and that it goes on intensifying as the generations succeed one another.

What is effected for the microbes' means of attack during an interval of a few hours would require the work of centuries in the case of parasites higher up in the biological scale. Yet the phenomena and the factors are essentially the same in each case. The hooks of the tape-worm, the "cupping-glass" of the remora, the suckers of the dodder—these are not found in worms or fishes or phanerogams which live a free life, not even on those which belong respectively to the same groups as the above parasitic organisms. It would seem, then, that these structural characters must have been developed by the organism when it betook itself to a parasitic career. This conclusion is strongly borne out by evidence from the life-history of certain species. Thus when the *Sacculina* fixes itself to the hermit-crab we see with our own eyes how the organs which are no longer useful are atrophied away, and others are formed to meet the needs of the new condition.

With the elaboration of the means of attack and their more and more perfect adaptation to the needs of the parasite, there is necessarily induced an *increasing specialisation*. As long as an organism lives at the expense of a number of different species, each of these defends itself in its own way, and the parasite, having to rely on varied means of attack, can never attain to the advantages which belong to

the specialist. Therefore it is to its interest to concentrate all effort upon a particular species; and the sustained action of this limitation has brought it to pass that certain parasites are so rigorously "adapted" that they are only able to live within a particular organ and at the expense of a particular species.

Furthermore, this implies the advantages of restricted competition among the exploiters. Each has his domain, a preserve free from poachers; the lice live upon the skin, certain hair-worms in the blood, the tape-worms in the intestines of their victims.

And among tape-worms there are several species which can only live upon a particular animal. The tape-worm of the dog (*Canis domesticus*) is incapable of living in the intestine of the fox (*Canis vulpes*). In like manner the Cestode which lives in the body of a mouse at the bladder-worm stage must pass into the intestine of a cat, if it is to develop into a tape-worm. If this change of host should be prevented by any cause (if, for instance, the mouse is eaten by an owl and not by a cat) the tape-worm in question finds its history cut short, for it cannot accomplish the full cycle of its development.

In speaking of the mildew of wheat, which requires to live for a time upon the barberry, we have already shown that other analogous instances of

extremely specialised parasitism are to be found among plants.

Still, among the rusts, or Uredineæ, as among the Cestode-worms, specialisation is not always pushed so far. Certain tape-worms are able to prey with equal success upon a number of different animals, and some rusts can complete the entire cycle of their life history while remaining the guests of a single plant. The one which infests the Alpine rhododendrons, for instance, can, if need be, maintain itself upon one of these the whole year round. Nevertheless, if it finds an *Epicea* within reach, it takes up its quarters with it during spring and summer. And as it cannot weather the winter through with its summer host, it gets carried back in autumn to the rhododendron.

(*b*) *Social Parasitism.*—Among social parasites a certain predisposition or aptitude for parasitic life may exist by organic inheritance; but the developing and perfecting of habits of attack are entirely due to imitation, in all its forms. Professional mendicants hand on a knowledge of "the ropes" of their pursuit, older pickpockets make a livelihood by training pupils to that craft, criminal gangs require new members to serve a noviciate, and as the conditions of civilised life become more complex, the parasites, as well as the workers, find it necessary to become specialists.

Examples of this tendency to specialisation are embarrassingly plentiful.

Prostitutes may be classified by reference to the class of persons upon whom they live. There are the women of the slums (*filles de barrières*), the women who associate themselves with soldiers (*filles à soldats*), the more "gay" description who are conspicuous in pleasure-parties (*filles à parties*), those associated with ale-houses (*filles de brasserie*), etc. Those different species—and one might easily cite many others—little by little develop habits, personal qualities, and modes of action suited to the habits and tastes of their special clientele.

Similarly nearly all usurers address themselves exclusively to a particular class of clients. Some will only do business with young men still living under the protection of their parents; others only lend small sums of money for short periods to working-class folk and to small tradespeople; whilst others again live upon the peasantry. So, too, it is customary for the proprietors of houses of ill fame to lend small sums, at usurious rates, to the prostitutes belonging to their establishment, not simply for the sake of the direct gain, but also, and more especially, in order to make it practically impossible for the latter to disentangle themselves and leave the house.

Other predatory parasites, likewise, have gener-

ally their own special clientele, and have recourse to stereotyped means of attacks, which they seldom vary. "A long experience has convinced me," says Locatelli ("Sorveglianti e sorvegliati," p. 69: Milan, 1876), "that each class of criminals employs a particular method peculiar to it, and specially adapted to the nature of its operations." Lombroso, to whom we are indebted for this reference, adds: "The cleverness or dexterity of criminals sometimes seems to us truly marvellous. But a closer view of the circumstances would leave less to wonder at. For we should find that if they perform their trick so well it is because they are always practising the same one."

Not only does the thief limit himself to thieving, but even this general profession is broken up into specialisms. Some confine their operations to shops and stores; others to private houses. Among the latter, there are yet further subdivisions to be taken note of. Vidocq distinguishes those who enter a house boldly and at hazard (*cambrioleurs à la flan*) from those who nurse their plans long and carefully (*nourrices*), take apartments hard by the house aimed at, and give themselves the air of quite reputable neighbours; or from those who proceed by coming to an understanding with the concierge, or providing themselves with false keys (*caroubleurs*); or those, again, who gain admittance by some pretence or other—as looking for rooms,

etc. (*chevaliers de la rampe.*) Take as another example the various "specialisms" of larceny exercised in the port of London. There are the "river-pirates," who pounce upon and pillage small boats, using weapons and violence;[1] the lightermen, who cut a hole in the grain sacks to increase their haul; the mud-larks, who pilfer pieces of iron and wood-work from the ships, etc.[2]

Association of criminals necessarily favours increased specialisation in means of attacks. "In the larger gangs," says Signor Lombroso, "you sometimes find a quite exhaustive division of labour. There is an executioner, a schoolmaster, a secretary, a commercial traveller, sometimes even a parson and a doctor."[3]

§ 3. *Change in the Reproductive Functions.*

1. *Organic Parasitism.*—The two forms of adaptation which we have been considering—the atrophy of organs no longer useful, and the development of new characters—make for the preservation of the individual parasite. We have now to consider the matter from the point of view of the species.

It is among endo-parasites that the most profound modifications must necessarily be brought about, in order to ensure (1) that fertilisation may take place.

[1] [This sounds rather like ancient history.—*Tr.*]
[2] Lombroso: "L'Homme criminel," p. 431.
[3] *Ibid.*, p. 522.

(2) that the reproductive elements, or the embryo-parasites, shall be able to escape from the body of the host inhabited by their parents, and (3) that they shall be able, in their turn, to attach themselves to a new host. We shall examine those three stages in their order of occurrence.

(*a*) *Means employed by the Parasite to bring forth Reproductive Elements.*—In many cases parasites inhabit the body of their host in very small numbers, or else as completely isolated individuals. Such is the case with the common tape-worm of man, for instance, which owes to this fact the name usually given it, "the solitary worm" (*Tænia solium*). Obviously, if it is to produce fertilised ova at all, it must be hermaphrodite.

In other cases fertilisation does not necessarily imply an hermaphroditic condition in the parasite. Among the Bopyridæ, for instance, the female alone is parasitic, and as she remains in direct communication with the outer world, the male (who lives a free life) has ready access to her. Other species living permanently at the expense of a particular host attach themselves in pairs in order to avoid permanent alienation from bed and board. Upon the horse-mussel (*Modiola*), a large bivalve, exploited by the pea-crab (*Pinnotheres*), we always find these small parasitic crabs in pairs of male and female. The two

sexes have not the same form, however, nor are they attached one to the other. But among a great many parasites (notably the Lernaeans) the male, who is very small, hooks himself on to the female, and lives at her expense, just as she lives at the expense of the fishes they infest. In many cases the degradation of the male is so complete that he ends by being little more than a testis appended to the generative organs of the female. Here we are only a few steps from the extreme adaptation which a parasitic life has evolved in the case of the tape-worm, in which each joint or proglottis is capable of being fertilised by its neighbour.

One step further brings us to parasites whose ova are able to develop without having been fertilised by spermatozoa (or male elements) at all. This is the case, for instance, with the Aphides or plant lice. These are very small compared with the host they infest, and are therefore able to multiply to an extraordinary extent without fear of their food-supply failing. In them sexual reproduction does not occur until the approach of autumn; only then are fertilised ova produced, which are destined to weather the winter.

(*b*) *Means employed by the Endo-Parasites to favour the Escape of the Reproductive Elements into the Outer World.*—At the stage in their life-history when they

are capable of producing reproductive elements, endoparasites nearly always inhabit some organ communicating with the exterior, among animals, the digestive tube and its associated organs. The tape-worm, for instance, inhabits at the Cysticercus (or asexual bladder-worm) stage the liver, the brain, or some other of the closed-in regions of its host's anatomy, but during its sexual phase it is lodged in the intestine, whence its ova are carried outward along with the excreta. The guinea-worm (*Filaria medinensis*) in its sexual stage forms a tumour under the skin, and lodges in the heart of it, and the dissemination of ova occurs when the host has the tumour opened. Analogous phenomena are found among the parasitic fungi. Their vegetative organs are developed entirely within the tissues of the host, but their spores are borne on the surface and scattered by the wind.

Some parasites, again, such as the ichneumon flies, complete their metamorphoses within the body of their host, but, becoming mature, they emerge and fly about freely, depositing their eggs.

(*c*) *Means employed to ensure that the Young Parasite shall secure a Host.*—Here there are three possible ways of attaining the end in view. Sometimes, as in the case of ichneumon fly, the mother takes it upon herself to deposit the eggs in a suitable host:

sometimes their transport is left to chance; sometimes, finally, the young parasite fares forth to find a host for himself.

1. *The first group includes all those parasites which are ordinarily regarded as free-living at the adult stage.* Those animals are indeed no longer parasitic when they reach the adult stage, seeing that they no longer take their nourishment from the substance of other organisms. But it is necessary to observe that in the majority of cases they now cease to take any nourishment whatever, and sometimes do not even possess a digestive tube or alimentary tract of any sort. When the ichneumon begins to bear fertilised ova it ceases to have any other function than that of going about and depositing them in the caterpillars, at whose expense the larvæ of this parasite live.

2. *In the second group of cases, the reproductive elements are unprovided with active powers of locomotion, and their arrival at their right destination is, in the main, a matter of chance.* But certain special characters have been developed, which increase the probabilities in favour of the parasite.

In the first place—and this remark applies to all parasites, whether plants or animals—they are so constituted that they produce germs, ova, seeds, spores in prodigious quantities.

Further, the reproductive elements sometimes have

structural characters, which peculiarly facilitate their transference to the environment where they are destined to develop.

A small mollusc which lives upon reed-grass encloses the sporocyst or larval stage of a Trematode worm, which, at its adult stage, inhabits the digestive tube of certain birds. This sporocyst appears upon the head of the mollusc in the form of an excrescence or outgrowth, in form and colour resembling a caterpillar. The bird, attracted by this deceptive guise, swallows at one swoop both host and worm, and the latter proceeds forthwith to live as a parasite upon the victim that had devoured it.[1]

We find similarly among parasitic plants a number of provisions for ensuring the germination of the seeds. These, in nearly every case, very small, and sometimes numbering millions for a single plant, are carried by the wind in every direction. Often, also, they are equipped with accessory organs ("wings," or pappus, barbs, silky filaments, etc.) which facilitate their dissemination. The mistletoe is an example of yet another kind of provision. Its berries are soft, and are eaten by birds, especially the thrush, and the seeds, being enclosed in a viscous sheath, traverse the digestive tract without suffering any change. The bird deposits its droppings upon a branch, the

[1] Lamere : "Esquisse de la Zoologie," p. 103.

seed glues itself to the bark, and thus it finds itself in the condition most favourable to its germination.

3. *There remains the third group, in which the young parasite searches out a host for itself.* Among plants we find but one example of this,—the dodder. The young shoots stretch themselves out to the utmost, and describe, at their extremities, spiral paths, which soon bring them into contact with the plants that are to be their foster-parents, and into which they insinuate their suckers. This is exactly the same phenomenon as is presented by the adult dodder itself; when it has drained its first host dry it stretches forth its branches towards an individual still intact.

Among animals there are many species of parasites, worms, crustaceans, insects,—which live a free life during the earlier stage of their history, and choose for themselves a host to fix upon.

The Melöes, for instance, are insect parasites inhabiting the nest of the humble-bee. The mother deposits her eggs at the foot of plants that are visited by these Hymenoptera. On issuing from the egg, the young larva creeps along the stalk of the plant and installs itself within the flower. When the humble-bee alights there to sip the nectar, it fastens on to the hairs of the visitor, and so gets carried home to the nest.

It is among the Trematodes that we find the most characteristic examples of the wanderings of para-

sitic larvæ in search of a host. The classic type is the liver-fluke (*Fasciola hepatica*) which inhabits the liver and bile-ducts of the sheep. It there produces eggs, which are expelled along with the excreta, and which, if they get into water, presently set free a microscopic ciliated larva. This larva swims about until it meets a certain mollusc (a small amphibious water-snail, *Limnæus truncatulus*), into the body of which it bores its way. There it becomes transformed into a swollen sac, called a *sporocyst*, from which may be formed a new sporocyst and also a second entirely different kind of larval form, called a *redia*, which begins to show the rudiments of a digestive tract. These *rediæ* form other *rediæ*, but ultimately produce yet another kind of larva, the *cercaria*, which corresponds pretty much to the liver-fluke in structure, but is provided with a muscular tail. The *cercariæ* emerge from their host, swim about for a time, and then become encysted within the body of other molluscs. The latter being in the habit of promenading upon plants which grow by the side of the water, are frequently swallowed by an unobservant sheep. Soon after arrival within the digestive tube of the host, the fluke is developed, and proceeds to lodge itself in the liver, where it attains its adult form.[1]

[1] Lamere . "Esquisse de la Zoologie," p. 102. [It is stated by some authorities that the cercariæ, after emergence from their moribund or dead host, encyst themselves directly upon plants.—*Tr.*]

Social Parasitism. — In studying social parasitism we do not find conditions completely analogous to those which we have just described in regard to the organic world; and that for an excellent reason. In the social world the continued existence of a given variety of parasite is subject not to the organic laws of reproduction but to the (psychic) law of imitation. Prostitutes are for the most part sterile, yet prostitution persists nevertheless. Castrate all existing criminals, and, in default of progeny of theirs, you will find a new supply of individuals ready to follow in their footsteps. Official idlers may be most convinced Malthusians, yet there will always be as many of them as there are sinecure offices—and more. The number of tape-worms, indeed, is limited by the number of ova that manage to attain their full organic development; but the multiplication of social parasites, being determined by the impulse to imitate, is limited only by the exploitability of the society that harbours them.

But does it therefore follow that we cannot recognise any real hereditary influence in the development of parasitic social types? Far from it. The total personal characteristics of parasites are not, indeed, hereditarily transmitted; but, as they are always of a more or less (physically) degenerate type, their offspring inherit that degeneracy, and are

thereby destined to one or other form of parasitic existence, if not to the special form affected by the parents. There can be no doubt, for instance, that "criminal" parasites procreate, as a rule, individuals who sooner or later go to increase the social residue; and in works on criminology we have all seen genealogical trees which display the most convincing proofs of this.

The question appears to be all the more serious, because of the fact that parasites—in the social world as in the biological—exhibit abnormal development in their vegetative life, and yet greater abnormality in their reproductive function. "In accordance with the law of compensation," says Schœffle, "parasites, since they do not expend much energy in muscular or nervous activities, should be found to be addicted to excesses of drinking, eating, and sexuality." Now we know what are the manners, in regard to these things, of the gilded youth of society, the morals of the decadent noblesse, the lechery of the parasites who wear the cloak of religion. The same truth applies to the predatory class of parasites, according to observations made by Dr. Corre;[1] also, of course, to sexual parasites.

Ought we not, then, to infer, from this tendency to abuse of the sexual function, that parasitic organisms

[1] Corre: "Les Criminels," pp. 163, 170.

and classes will be more prolific than their victims, will multiply more rapidly than they, and cause a steady augmentation in the number of the degenerate?

We do not think that this issue is to be feared, for a large number of factors operate against it, acting sometimes separately, and sometimes with simultaneous influence.

1. First there is the reproductive incapacity of the degenerate. Madame P. Tarnowsky dwells upon this factor at great length in her study of the thief and prostitute species.[1]

2. Secondly, there is the exceptionally high rate of mortality among those classes whose mode of life is akin to the parasitic, although it does not exhibit complete degeneration; for instance, beggars, vagrants, etc.

3. Thirdly, apart altogether from the physiological causes operating against the multiplication of parasites, we must also take account of the fact—which is, in practice, even more important—that it is generally in their interest not to increase their own numbers overmuch, and that they consequently have recourse to preventive expedients. Individuals of

[1] "Bibliotheque du progrès médical;" and Lecrosnier, 1889, ch. viii, "Extinction de la race chez les prostituées," pp. 55, 59, 61.

the *rentier* and sinecurist classes are generally Malthusians from purely selfish motives, since they are loath to be burdened with the charges of a family. Thieves, again, have relations for the most part with prostitutes; and the latter are, as a rule, infertile, either because they procure abortion in time, or because the condition of pregnancy being an obstacle to them in the search for patrons, they are careful to render the sexual act of non-effect by the employment of expedients sufficiently well known.[1]

4. Another factor which must certainly be taken into account is the strong desire of certain orders of parasites to withdraw their children altogether from the influences of an environment and mode of life which they themselves detest. Parent-Duchatelet has verified this fact over and over again among prostitutes, and Lombroso makes it equally certain that thieves and receivers of stolen goods who have become "better off," follow the example of so many women of evil life in striving to keep from their children all knowledge of their profession and career.

Taking all these facts into account, then, it would seem that we have little reason to fear the possible multiplication of parasites through the influence of

[1] Fiaux: "De la pretendue stérilite involontaire des prostituées." Paris, 6th May, 1889.

heredity. If parasitism produces organic degeneration, this is followed by sterility. If it does not, the parasites themselves find it in their interest to limit the number of their children, and have so little care for those that are born that the rate of mortality among them is exceptionally high. Moreover, on the last hypothesis, since the children who survive are not degenerates, they are not committed by physical unfitness to a parasitic scheme of life.

The real danger lies in *imitative* multiplication, favoured by a social order which facilitates the development of parasitism. But the methods of obviating this danger belong to the subject of our last chapter, where we shall speak of the Means of Defence against parasitism.

Here, however, let us remark in conclusion that whatever be the favouring causes, and however faulty the social organisation may be, there always remains at least one effectual limitation to the increase of the parasitic classes: their number ultimately depends upon the number of those upon whom they can prey. Examples could be cited, it is true, of tribes and peoples almost entirely parasitic; but these are not strictly cases of *social parasitism*, but rather instances of an external horde extorting their maintenance from a population more numerous than themselves. It is in that way that plundering tribes live

upon the agricultural population in certain regions; that the Dutch exploit the inhabitants of the East Indies; and, to take an example from among sexual parasites, that the daughters of the Ouled Naïl go to earn their dowry in the brothels of large Algerian towns.

CHAPTER IV.

Influence of Parasitism upon the Host.

The modifications which parasitism produces in those who are its victims may be classified under three heads. (1) The weakening of the organism preyed upon; (2) the growth of an internal obligation (an organic need) to minister to the parasite; (3) the development of means of defence (protective apparatus) against the enemy.

§ 1. *Weakening of the Host.*

That an organism must be weakened by having another living at its expense is a fact so evident that we need not insist upon it at any length here. Only, it goes without saying that the extent of the damage varies exceedingly. In the case of a tree which merely supports a climbing plant, or in the case of leaves whose colour is mimicked by a certain species of insect, the injury received is infinitesimal. In other cases, on the contrary, the parasite effects such ravages that the death of its victim is not long delayed.

The *Phylloxera*, for instance, has destroyed outright

thousands of vines; and similar devastation is wrought by the various maladies due to the action of microbes. We may mention also the strange affection known as miner's anæmia, which was specially common among those engaged in the Mont-Cenis boring operations. The anæmia is produced by a worm (*Anchylostoma*), which lodges itself in the duodenum, lives upon blood, and may drain its host so completely that he succumbs altogether.

A very strange illustration of the disastrous consequences sometimes resulting from parasitic exploitation is that given by M. Paul Combes in his book on "Animal Civilisations." The habitual parasite of the honey ant is a mite which develops within the ant-hills in such abundance that sometimes the body of nearly every ant in the community is infested. An ant-hill so invaded is like a city in which the plague has taken its abode. The ants perish one by one, and you will see on the burial road nothing but a procession of dead being carried to a common grave. The galleries become desolate; the sick ants presently become unequal to the duties of sepulture, the corpses are left lying in chamber and corridor, and at length the moment comes when the last inhabitant of that house perishes alone among his dead.

The social parasitism which consists in levying a tax on the means of subsistence does not cause such

grave perturbations as the nutritive parasitism of the organic world to which it is parallel, and of which we have just described some of the results. Nevertheless, it sometimes happens that the parasites of human society multiply to such an extent, or attain such a degree of virulence, that they completely exhaust the resources of the workers upon whom their existence depends. Spencer reports that in the East the rapacity of monarchs has sometimes been carried so far: they have taken from their subjects such an enormous share of the whole produce of the realm, that they have had to give them back some seed, that there might be a harvest next season.

Spain, as it was at the end of last century, may be regarded as the type of a community reduced to a state of unhealth, a kind of economic consumptiveness, by the frightful multitude of parasitic individuals and of persons who were engaged in work, indeed, but in work that added little to the resources of the country. It has been calculated that in the time of Philip III. there were 988 convents and 32,000 begging friars; the number of monasteries had tripled during the fifty years preceding 1624, and the number of friars had increased in even greater ratio. But the census of 1788 gives a total of 1,221,000 priests, soldiers, marines, nobles, lawyers, custom-officers, students, and domestic servants; this, in a population

of about 3,800,000 men, from which a further deduction must be made on account of great hordes of beggars, vagrants, etc.[1]

§ 2. *Services rendered to the Parasite by the Host.* It would be a mistake to suppose that organisms exploited by parasites attempt in every case, with more or less energy, to disengage themselves from the burden. A great number submit without reacting in the faintest degree. Some even render free services to their exploiters, and, in the domain of organic parasitism, we find them modifying their structure so that they become more useful to those visitors.

Very remarkable, says M. Paul Combes, is the habitual powerlessness of animals to struggle against parasitic imposition, and their ineffectiveness when they do attempt to fight in their own defence. The social Hymenoptera—ants, bees, wasps—well provided with weapons as they are, neither have the sense to exterminate their enemies, nor do they even seem to recognise them. In the presence of their habitual parasites, these insects, in other respects so sagacious, seem to be struck blind.

As for crabs, when one of them is attacked by a *Sacculina*, the victim is not content with merely sub-

[1] Roscher: "Principles d'Econ. pol.," ii., pp. 144, 145 (Wolowski's French trans.).

mitting passively to exploitation, but has its own structure modified so as to protect the parasite. The tail of the female crab, as everyone knows, is segmented and flexible, and thus very effectively protects the eggs which the creature carries under it. Now, when a crab, whether male or female, is fastened upon by a *Sacculina*, it is nearly always rendered completely sterile. And it has been proved that in the case of the female the tail now protects, instead of the eggs (for there are none) the parasite which has usurped their place; while, in the case of the male, the tail (which is ordinarily segmented without being actually flexible) becomes almost identical in character with that of the female.

Phenomena analogous to this are met with often enough in the vegetable world.

The *Melandryum album*, belonging to the Caryophyllaceæ or chickweed order, becomes diœcious by abortion. The flowers ordinarily contain, at the time of birth, both stamens and pistil; but in certain individuals the stamens subsequently atrophy, and the individual becomes female, whilst in others, on the contrary, the development of the pistil is arrested, and so all flowers become male. Now there is a fungus (*Ustilago antheridarum*) which lives as a parasite on this plant, and produces effects entirely similar to the parasitic castration of the crab

by the *Sacculina*. If the fungus fixes upon a male flower, it installs itself in the anther, so taking the place of the pollen grains, and sterility results as a matter of course. If it fixes upon a female specimen, there are more complex changes. We now find that the pistil atrophies; moreover, that under the influence of the *Ustilago*, which is, as it were, interested in procuring an anther to lodge in, the stamens, which would otherwise have remained rudimentary, acquire the form which they have in the male flower.

Another typical example of this sort of adjustment is presented by the transformation undergone by certain leaves under the action of the Cecidomyiæ (midge-like insects belonging to the order Diptera) which inhabit them.

In many instances it is found that the leaves on the under surface of which the insects are sheltered are recurved towards their base in such a way as to form a roof or umbrella, and so protect their visitors from the effects of bad weather (*Cecidomyia persicariæ*). In another class of cases the branch infested does not grow out so as to have its leaves disposed at a regular distance from one another. By remaining short and reducing to a minimum the internodal spaces, it crowds its leaves so close together that they are arranged in rosettes, and these form veritable cradles for the insects which they shelter. This adaptation

is found especially in *Salix repens*, the small silvery willow of the dunes. Sometimes, it may even be that the leaves show little box-like structures, within which the insects (*Cecidomyia bursaria*) lodge.

These instances of self-adaptation of the host to the needs of its parasite are by no means exceptional, and it would be easy enough to cite others. Here we shall only refer to the production of the nutritive material within the galls which certain insects inhabit. Inasmuch as this adaptation is apparently advantageous to the host (serving to localise the parasite within a definite region), we shall speak of it again in connection with the means of defence.

In the world of human society, it is so common to find the victims constrained to render surplus-services to the parasites who exploit them, that few examples need be quoted. The working-classes, especially in civilisations of the lower type, submit to the domination of proprietary and political parasites with such utter resignation that the latter do not hesitate to impose upon them the additional burden of protecting their property and defending their privileges.

In his celebrated memoir upon Loans, Turgot states it as a fact that the feeling of the common people towards those *prêteurs à la petite semaine* (petty usurers) who lend them small sums at exorbitant rates of interest, is one of gratitude rather than

hatred. "I remember," he says, "having had to prepare a report to the *Tournelle* regarding a case of criminal usury. I was never in my life so appealed to in favour of anyone as I was in favour of the unfortunate accused; and I was surprised to notice that those who interceded with such insistent earnestness were the victims of those very acts of usury which the law was intent on punishing."

In their enquiry concerning prostitution (conducted at Geneva in 1888), MM. Picot and L. Bridel had occasion to verify the existence of similar traits and tendencies among the inmates *(pensionnaires)* of the recognised brothels. "Once a woman allows herself to be captured, she loses the power to resist. Removed from intercourse with the world, transplanted perhaps into a region that is strange to her, and perpetually bond-held by debts, she endures her condition until it seems to her almost a normal one, and even develops a sort of professional sense of duty which forbids her to be untrue to her engagements with those who exploit her." We need not wonder, then, that a custom obtains in most of those establishments which imposes on the unhappy inmates an obligation to render a great many small services to the keeper (master or mistress) of the house, and to present obligatory gifts on stated days of the year.

Generally speaking then, it may be said that the

resisting power, the capacity for reaction, grows steadily feebler the nearer we approach to the lowest conditions of social life; and that there is a proportional increase in the characteristics of passivity and servility, the attitude of the willing slave. We must remount towards the higher strata of human societies if we would observe the operation of means of defence, more or less energetic and effective, against parasitic exploitation.

§ 3. *Development of Means of Defence.*

The various means of defence against parasitism may be grouped under two terms—(1) *repressive* measures, aiming at destroying the parasite outright, or at expelling it, or at rendering it incapable of doing injury; (2) *preventive* measures, either making it impossible for the parasite to get access to the organism or community which is menaced, or else increasing the means of meeting and resisting attack.

1. *Repressive Means.*—For the repression of parasitism recourse may be had to the following methods:—(*a*) *Complete destruction of the parasite;* (*b*) *Expulsion;* (*c*) *Incarceration;* (*d*) *Localisation within a determined area,* thus securing certain advantages; (*e*) *Transformation of the parasite into a non-parasitic individual.*

(*a*) *Destruction of Parasites.*—This method of action has been specially studied in connection with the treatment of those diseases which are due to the

presence of microbes. In a great number of cases immunity from the attack of hurtful or pathogenic Bacteria means that these enemies are destroyed by the organism attacked, or rather by certain cells (the leucocytes or white blood-corpuscles) which are specially adapted for this function. A kind of education of the organism, from this point of view, may be undertaken; vaccination, for instance, being effective just because it increases the microbe-absorbing power of the leucocytes.[1]

Complete destruction of the social parasites is an expedient to which animal communities often have recourse. When the male bees have fertilised the queen bee, they are massacred wholesale by the sexless workers, for they are no longer of any use. Sentinels, also, are posted around the hive, who pursue and slay any strangers that may attempt to gain an entrance by stealth.

Similarly, in human society, persons guilty of the greater crimes are put to death; and in times of revolution a certain number of parasites are usually "suppressed." Nevertheless, it is certain that with the continued progress of civilisation there must come an increasing abandonment of this and other repressive methods in favour of preventive ones. To convince oneself of this one has only to compare the

[1] [This is one view of the matter.—*Tr.*]

laws of to-day with the penal code of the ancient regime, and of existing communities which are less advanced in civilisation, where we find the death penalty meted out as punishment for the most trivial offences.

(b) Expulsion of Parasites.—This method of defence can hardly be said to be met with among animals, which seem to be but little aware of the parasite's presence. Still, there are sometimes purely reflex actions on the part of the organism which make up for the absence of conscious action. Thus in a tumour the purulent matter consists in part of the white blood-corpuscles which have swallowed the microbes, and so these are shed when the tumour is emptied. Dendy is of opinion that the loss of the visceral sac, which sometimes occurs in the *Comatula* or sea-lily, without causing death, procures release from the parasites which "gnaw the entrails" of this organism. If that be so, then we have here a case of protective "autotomy" or self-mutilation.

From the human organism parasites are expelled by many methods. It is sufficient to refer to vermifuges.

In dealing with social parasitism, the expulsive method is very frequently employed. Departments of public safety have been instituted for the special purpose of seeing that all dangerous persons be taken

back and set outside the frontiers. England, France, and other countries get rid of many of their criminals by deportation; and some governments have driven the religious orders from their territories as being useless or injurious to the country. In line with the same order of ideas is the Act of Congress passed by the United States in 1882, which commands the sending back to their own country of all criminals (condemned persons), madmen, idiots, and, in general, "every person who, from what reason soever, is unable to take care of himself, and likely to become a public charge." By the operation of this Act there were sent back to their own homes, between the years 1882 and 1889, no less than eight thousand emigrants.[1]

(c) Incarceration.—This method of defence is not confined to human society. In the case of certain animals—for instance, the gerbil (*Gerbillus*) and the pouched marmot (*Spermatophilus*), small rodents inhabiting, respectively, Algeria and Southern Russia—it has been proved that tubercle Bacilli are quickly engulfed by the cells. The latter give forth a secretion which forms a hard case around the Bacillus, and in this prison it finally decomposes or returns to its elements. The incarcerating process is more completely

[1] *Revue d'Econ. pol.*, 1891, p. 33. Mayo Smith: "La politique des Etats-Unis relative a l'emigration."

affected by the gerbil than by the pouched marmot, and this more effectual imprisonment is associated with a more complete immunity. We cannot doubt, therefore, that it is with a view to self-defence that the organism imprisons the parasite in this chamber of doom—a veritable oubliette.

Similarly we find that the *Trichinæ*, which are found coiled up in spirals within the muscles, are always surrounded by a cyst with resisting walls, from which the worm is unable to escape. The difference is that here the cyst is secreted partly by the host and partly by the parasite, so that we seem to have here the concurrent operation of an act of self-defence on the part of the organism attacked and an expedient to ensure security on the part of the aggressor.

(*d*) *Localisation of the Parasite.*—It sometimes happens that an organism, being unable to free itself entirely from its parasites, does what it can by trying to limit the area of their ravages, and confine them within a certain pale where their needs are so well supplied that they can have little occasion to wander further afield. Thus there is established a kind of *modus vivendi* between host and guest.

We have already noticed the occasional presence in plants of proliferations of their cellular structure, commonly known as "galls," and having a resem-

blance to fruit. This cellular mass gathers around an egg which has been deposited in the plant by an insect. When the egg hatches, the larva finds itself in the heart of the gall, in a house whose walls consist of young and tender fibrous matter, containing very nutritious food supplies. It is to be remarked here that this accumulation of nutritive substances, especially albuminoids, has no other purpose or reason for existing save to accommodate the larva. It is not a reserve store of nourishment which the plant has laid up for itself, being solely devoted to the use of the parasite. The latter, then, finds in its immediate surroundings all that is necessary for its development, and thus has no occasion to change its ground, or go forth and attack other regions of the plant. The gall which is produced upon *Hieracium umbellatum* by *Aulax hieracii* is one of the most striking examples of this phenomenon.

We may, perhaps, regard as analogous to this method a certain expedient recommended by Dr. Mireur for staying the ravages of syphilis. He was in favour of the establishment of syphilicomes, where infected prostitutes should be received, and, although not sequestered from the community by force, should yet be so well treated that they would have no inducement to go out any more and spread disease in the practice of their trade.

In the social world the limitation of the ravages caused by parasitism is sometimes made the subject of an actual contract between the victims and their exploiters. In Hungary and other countries infested by brigands, the inhabitants purchase immunity from molestation, by undertaking to pay tribute —payments either in money or kind. Similarly, Roman functionaries in the time of the empire sold to the inhabitants of their provinces various immunities—such as exemption from imposts—in return for payment of a slump sum.[1]

(*e*) *Transformation of the Parasite.*—This means of defence is only valid in relation to the social parasite, and then only so long as we have not to deal with a degenerate type.

In default of a complete analogy in the organic world we can perhaps say, with a certain amount of reason, that results *somewhat* analogous are produced by vaccination when it acts not by destroying the Bacteria outright but merely by rendering them innocuous. When a guinea-pig is inoculated against diphtheria, the resulting immunity does change the parasitic Bacteria into non-parasites to this extent that they no longer have any hold upon the organism. Only the fact of course remains that those microbes are still entirely unchanged as to their real constitu-

[1] Spencer: "Principles of Sociology," vol. iii., p. 341.

tion, that they retain all the properties which make them hurtful, and can exercise these as effectively as ever against an individual which has not been rendered immune.

For the transformation of social parasites recourse is had to two general methods: moral influence, which has but little effect upon the adults, and the whole body of legislative enactments, bye-laws, etc., which attempt to inhibit the parasitic classes, or to make it impossible for them to turn to account the facilities they may have for exploiting the community.

To this second category really belong not only the public laws and municipal regulations against usury, prostitution, and the various kinds of theft, but also enactments for the suppression of hereditary privileges and the abolition of public offices which have become parasitic.

And thus we are brought to the borderland where *repressive* means are almost identical with *preventive* ones, to which our concluding pages must now be devoted.

2. *Preventive Means.*—Preventive methods of dealing with parasitism aim either at increasing the internal power of reaction, whether of an organism or a community, against attack, or at making it impossible for parasitic foes to gain access.

1. In illustration of the latter case we need only cite the hygienic precautions resorted to in times of epidemic, more particularly the disinfection and filtration of the water supply.

The hardening of the surface of the body in insects and crustaceans probably acts as a defensive provision against parasitic attack; but in both these cases we find that the parasite still finds himself a berth in the membranous region which extends between adjacent segments, and which is indispensable to the mobility of these.

In certain defensive partnerships formed between plants and ants, the preventive policy seems as if based upon a quite rational deed of agreement. Thus there are certain large ants in South America (*Œcodoma*) which are in the habit of ravaging trees and stripping off the leaves. These they carry to the ant-hill, and form with them what correspond to mushroom beds, fungi being their chosen food. To fortify themselves against the attack of these devastators, the plants enter into association with a different species of ant. The latter constitute themselves into a bodyguard for the defence of the tree, and receive from it an equivalent for these services in the form of board and lodging.[1]

[1] [There is here, as in some other pages of this book, a suggestion of conscious or deliberate action on the part of various organisms, which seems to us unwarranted; but it does not affect the argument.—*Tr.*]

There is not much difference between this arrangement and that which we find prevailing in Tunis to-day, where the occupiers of the land pay, in the form of impost dues, for the maintenance of the French garrison which defends them from the plundering inroads of the Sahara tribes.

Equally to be regarded as precautionary measures against the approach of parasites, are those laws of the United States which interdict the immigration of vagrants; or the article in the Civil Code of Montenegro which, aiming at land monopolists, declares it against the constitution for any foreigner to own—unless by special authorisation from the prince—the smallest parcel of land within the domain of Montenegro.

2. Of the defensive means and methods whose effect consists in augmenting the resisting power of the organism attacked, *vaccination* is the best general type. It enables the organism either to grapple with and destroy the pathogenic bacteria, or to reduce their influence to nil by cancelling the action of the poisons which they secrete.

For social groups we would give as the best of all preventive expedients (1) *The suppression of hereditary privilege*, and (2) *A further development of the principle of association in all its forms.*

In the majority of cases social parasitism takes its

rise from the customs, moral traditions, and laws that make entry into the higher professions, and the State offices depend upon hereditary privilege. It is, of course, true that inherited privileges play a narrow, and ever narrower part in the systems of modern society. Still, it is none the less certain that, even now, every day produces its crop of deplorable illustrations of the effects of hereditary privilege in the life-history of the proprietary parasites—with the retinue of usurers, "budgetivore" companions, prostitutes and evil-doers who are engendered by their rankness and carried in their train.

It is because society must resist their exploiting practices, and prepare for the final suppression of their privileges, that the principle of association has become an inevitable necessity. Wherever solidarity among the workers is realised, parasitism becomes impossible. The credit bureaus (*sociétés de crédit*) founded by Raiffeisen in Germany and by Wollenborg in Italy, have routed usury altogether from the villages in which they have taken root. Building societies are hindering the speculators from making the houses of the working classes a source of exorbitant gain. The great co-operative societies of different countries form a most effectual safeguard against the parasitism of intermediary dealers, who, expensive and useless though they be, multiply and

abound in every department of retail business. The family communities among the Slavs of the South, the Mir of the Russian peasantry, the Almen of the Swiss cantons, every form of agrarian collectivism, indeed, displays (albeit associated with many disadvantages) the one inestimable advantage of placing a veto upon land-monopolisation, and upon the parasitism which results therefrom.

And there can be no doubt that it is in the direction of such examples that our reforms must tend if we wish to fight effectively against the propagation of parasites. The breed of the parasite will become rarer and rarer in proportion as social solidarity becomes more common and assured, and in proportion as we bring to pass—what St. Simon prayed for—a complete disappearance of those inherited privileges which make possible the exploitation of man by man.

SUMMARY AND CONCLUSIONS.

In the foregoing study we have considered the whole subject of parasitism under its most generalised aspect, and have brought under the one conception of organic parasitism phenomena so different as those of nutritive parasitism, exploitary parasitism, and mimetic parasitism.

Under any of these forms, we have seen that parasitism is always a habit derived from a pre-existing, non-parasitic condition of life; and that its adoption results in a double series of modifications—changes in the parasite and changes in the host.

The changes in the parasites are: disappearance of organs no longer active; development of new characters (primary and secondary adaptations) fitted to facilitate the exploitation of the victim; transformations in the reproductive function, tending to ensure that the parasite shall reach what it is fitted to exploit.

The effects upon the host are found to be comparatively unfavourable life-conditions, from the very fact of being exploited. Efforts, more or less effectual, are

put forth in the direction of self-defence. The host sometimes contrives to make the parasite do him service.

Those observations are equally true of social parasitism, except as regards the reproductive function. We have found that the social parasite does not transmit his economic character by organic inheritance, and that the laws of reproduction play but a secondary part in keeping extant the different varieties of parasites. The leading factor at work here is the imitative impulse.

This fact suffices to explain why social parasitism does not result in such profound changes as the organic world displays. A man is not born a social parasite, but acquires that character in the course of his life-history; and, being an acquired character, it is not transmissible.[1] Nevertheless, such modifications as do occur operate in the same direction as those which are so well marked in organic nature. The society which is exploited by parasites becomes feeble; the parasitic individuals tend to degenerate.

If the society is poorly or defectively organised, there is a free multiplication of the parasitic classes, and the

[1] [The authors here adopt, without question, the belief of Weismann and others that characters acquired from function or environment during the lifetime of the individual are not transmissible. But it is hardly proven.—*Tr.*]

collapse and total ruin of that society soon follows. On the other hand, if the resistance which it offers to exploitation be at all adequate, there will be a speedy elimination of the individuals and classes who become parasitic.

THE END.

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